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MODERN PLASTICS

E. F. LOUGEE, Editor
C. A. BRESKIN, Publisher
Dr. G. M. KLINE, Associate Technical Editor

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Next Month

We shall publish a Progress Report on Denture Base Materials by W. T. Sweeney, A.B., research associate of the American Dental Association at the National Bureau of Standards, and Irl C. Schoonover, Ph.D., assistant chemist, National Bureau of Standards. This is a report to the Research Commission of the American Dental Association and appeared in its Journal in August 1936. It outlines rather completely the progress which plastic materials have made in the field of dentures during the past few years and we have secured some interesting photographs for its illustration.

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RECORD ACHIEVEMENT

by EVE MAIN

In which a comparatively new type of plastic material has helped an old industry retrieve its lost popularity

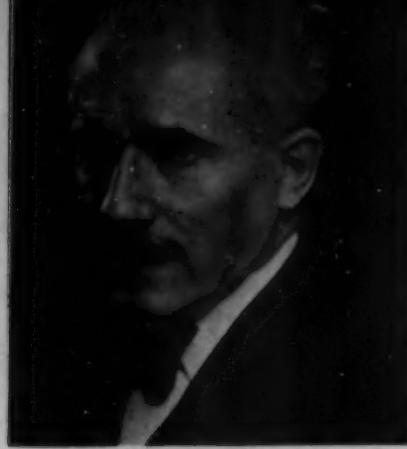
"RCA VICTOR PLANS TO WIDEN PROMOTION Activities" announced a headline recently in a New York newspaper. In the body of the news item was a paragraph reading: "An additional fifty per cent increase in the advertising appropriation for phonograph records will recognize the four-year advance in record sales and revival of the demand for phonographs." Since with the rapid strides being made in the development of radio some ten years ago, leading authorities predicted that phonographs and records as a means of home entertainment would become obsolete, even as horse drawn bug-

gies and carriages gave way to automobiles, and street cars were replaced by streamline buses, this news item seemed inconsistent. As far back as 1924 sales of phonographs and records began a downward swing that very nearly reached bottom by 1932 with only temporary upward spurts through the introduction of a new and improved model or occasional bursts of promotional activity. Apparently, however, the phonograph business was just doing a Rip Van Winkle and has awakened to carry on an important industry with fresh impetus. Being of an inquisitive turn of mind we set out to learn

Albert Spalding, violinist, looks through the microscope to make sure the surface of the wax recording disc is smooth and free from specks of dirt or foreign matter which might easily interfere with clear, true recording for reproduction

Raymond Sooy, chief recordist monitor of RCA Victor, at his post in the control booth just outside the recording room. It is his job to regulate volume and he has controlled all great recordings from Caruso to the latest Toscanini album





ARTURO TOSCANINI



LEOPOLD STOKOWSKI



"FATS" WALLER

Arturo Toscanini whose recording of Beethoven's Seventh Symphony, shortly before leaving for Europe, will thrill music lovers for years to come. Leopold Stokowski as he conducts symphonic recordings that will be treasured in many a music library. The lilting rhythms of "Fats" Waller, king of "swing" music, are faithfully reproduced on Victor records

the whys and wherefores of this phenomenon. Our search after knowledge led first to the RCA Victor Co. in Camden, N. J., where we were courteously received and much enlightened.

It seems that for the past four years, phonographs and records have been slowly but surely creeping back into popular favor. This, despite the fact that in 1933 about 750 broadcasting stations in the United States were sending out regular programs to more than 15,000,000 owners of radio receiving sets. During the first seven months of this year RCA Victor phonograph record sales show nearly a 100 per cent increase over those for the same period of the previous year, and during the summer months which are usually dull, sales were actually better than they were last December which was the best month in many years. The month of August alone shows a gain of 225 per cent over the same month last year. These increases appear in all types of records ranging from classical and currently popular "swing" music to hillbilly records.

What is responsible for the seemingly unprecedented return to popularity of phonograph records? We are told by RCA Victor that several factors have influenced the upward swing. First: Strangely enough, although radio was Public Enemy No. 1 to the record industry, it has actually contributed in no small measure to the present growth and expansion of this same industry. For radio, through generous use of outstanding symphony orchestras, opera and concert soloists, has raised the musical standards of its listeners until they have acquired a taste for really good music, and know more about it than they ever did before the days of radio broadcasting. Along with this knowledge comes the desire to hear over and over again some favorite orchestra or soloist and there is no more convenient way to gratify this desire than to purchase records for use at home.

Second: Perhaps more important than any other single factor is the improvement in materials from which records are made. To sustain interest in phonograph music, records must be kept to a high standard of performance for upon them much of the success of the reproduction depends. When Thomas A. Edison invented the phonograph back in 1877, with its cylindrical records, it would have been difficult to imagine just how far toward perfection this method of sound reproduction would go. If we were to listen to the squeaks and squawks of some of those early records in comparison with current recordings, the difference between the two would be astonishing. Although the phonograph had many difficulties to overcome, its greatest difficulty was true reproduction of orchestration and vocal music. In addition, records themselves were usually short-lived. The material from which they were made was easily broken or cracked, and the "plop, plop" of a cracked record made it useless. These conditions have to a great extent been overcome by the use of plastic materials for records, which after extensive research and experimentation have proved ideal for the purpose. RCA Victor's standard black label and red seal records for home use are made from a material consisting of special grades of

shellac plus filler and black pigment. The thin, flexible records such as are used for broadcast and slide-film purposes are made from Vinylite,* a vinyl resin, to which filler and black pigment is added and the resulting material is called "Victrolac." Limited quantities of these records are also produced for home use but are slightly more expensive than the shellac records. Through the use of these materials and a "higher fidelity" sound recording process, it is possible to faithfully reproduce music so that it actually exceeds the definition and tone quality of a radio performance.

Third: Through improved economic conditions people are beginning to have more money to spend and are consequently more often able to indulge their musical inclinations by purchasing more records.

Fourth: As a further inducement to record purchasers, RCA Victor engineers have developed an inexpensive record-player which may be attached to a radio. It consists of a walnut finished chest about $8\frac{1}{2}$ in. by 11 in. that looks much like a cigar humidor when not in use, which can be placed on an end table or on the arm of an

easy chair and connected with the radio receiver by a long cable. When the cover is taken off, a small turn-table and phonograph pick-up arm are revealed which will accommodate the standard 10 in. and 12 in. records. Volume is controlled from the instrument itself. Sound is transmitted through the loud-speaker and radio amplification system of the radio receiver which may at any time be switched back to radio reception. The chief advantages of this device are its small initial cost—well under \$20.00—and its convenience since records can be changed without getting up from the chair. It is easy to see how this handy little gadget increases record sales by providing satis- (*Continued on page 63*)

* Trademark registered.

1



2



3



1—This Library of Recorded Music and new phonograph-radio with dynamic amplifier insures full enjoyment of old-time as well as modern favorites. 2—Control room of Muzak Corp. where musical programs are relayed over telephone wires to the receiving sets of subscribers. 3—One of the several styles of compact and attractive receiving sets for subscribers to Muzak Corp.'s service

EDITORIAL COMMENT

THE FIRST MODERN PLASTICS COMPETITION HAS come and gone, leaving behind it an amazing trail of widespread interest and achievement beyond our fondest hopes. The hundreds of entries have been on display at the Metals and Plastics Bureau on the third floor of the International Building, Rockefeller Center, since October 29 where thousands of visitors have had ample opportunity to witness the progress these man-made materials have made in the fields of industry, decoration, and style. Here they will remain until November 22, when they will be transferred to Pedac Galleries, tenth floor, R. C. A. Building, 30 Rockefeller Plaza, to be exhibited under the auspices of The International Society of Arts and Decoration until the end of December. Our readers are cordially invited to visit both these exhibitions as our guests.

This Competition indicates in a measure that the Romance of this Business of Plastics goes much more deeply than the surface with which we come in casual contact. It smacks of the pioneering of early days and of the constant struggle which has brought this country to its present stage of happy existence. It clearly points to a future whose greatness no man can describe, nor even guess.

If the Competition did nothing else, it brought out the typical approach and attitude of industry toward the philosophical acceptance of new materials with which it is not yet entirely familiar. It revealed significant examples of engineering endeavor to supplant older materials with something better for the purpose, or cheaper. But, even more important than this, was the marked tendency by those far removed from the plastics industry itself to cooperate for the benefit of all concerned.

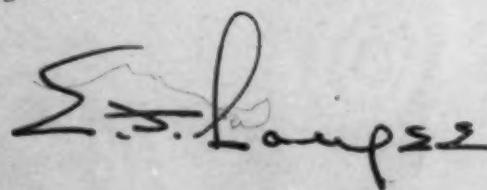
ROMANCE IS NOT ENTIRELY ABSENT FROM THE knowledge that from the same plastic brew which gives fire resistance to the laminated surfaces in the "SS. QUEEN MARY," comes the thin transparent and flexible film on the Silver Evening Wrap which won First Award in the Style Group.—Or from the thought that from the same kettle come the slender strands of synthetic fabric which are fashioned into beautiful gowns; and the molding compound which under pressure and heat becomes the steering wheel and horn button on your automobile.

All day long chemists sit quietly in their laboratories experimenting hours on end, trying this and testing that, until some new combination of ingredients gives industry a brand new material; or until one of the known materials is brought to a greater degree of perfection. Then a casual announcement whets the imagination and sends hundreds of engineers and designers scurrying for further details of property values and technical information.

Given this new material, or an older material which has been further perfected, these engineers and designers sit out on the edge of their chairs, whittle their pencils, scratch their ears, and begin planning just how they can make the best usage of it. What will it give them that they didn't have before? What will the new material do that other materials have failed to do? How can production be stepped up and costs reshaped to increase sales? The answers usually are not far away and the ingenuity resourcefulness and imagination of these creators of industry become quickly apparent.

THERE IS DRAMA IN THIS BUSINESS OF PLASTICS, too. If you have stood on some roof in Manhattan or in the garden of your country home and watched the graceful gleaming airship from a distant shore glide almost silently overhead; if you have realized that it has traversed the distance of nearly three thousand miles across a treacherous and unfriendly ocean in little more than the space of one day and one night; you have thrilled to an accomplishment of science in which plastics play a prominent part. Or, if you prefer your Drama in smaller portions, consider that a few teaspoonsful of molding powder constitute the ingredients which under tremendous pressure and heat become the gearshift knob on your automobile. A simple inert device which never gets too hot to handle comfortably in Summer, nor yet too cold in Winter.

If the Romance of Plastics was indicated in our Competition, the Drama of Plastics was exemplified in our October issue which gave our readers for the first time a complete Handbook and Guide of the industry in layman's language.



PRESENTATION DINNER

THE CONCLUSION OF MODERN PLASTICS COMPETITION was celebrated with a presentation dinner on the evening of October 29, at which \$750.00 in cash awards was distributed to those engineers and designers whose entries were chosen winners by the judges. Seventy-three engraved plastic plaques were also distributed to those companies who sponsored the entries and whose product or services entered in any way into their design or production.

Two hundred and eighty guests attended the dinner which was served in a room adjoining the Metal & Plastics Bureau, International Building, Rockefeller Center, where the entries in the Competition went on display. The event marked the official opening of the Bureau.

Robert B. Krogstad of the Bureau welcomed the guests and introduced the toastmaster, E. F. Lougee, editor of MODERN PLASTICS. The speakers included Dr. Howard L. Bender, chief of research at the Bakelite Corp.; Hugh Bennett, president of the Toledo Scale Co., and winner of the First Award, Industrial Group in the Competition; Harvey Wiley Corbett, architect, and one of the judges in the Competition; E. C. B. Kirsopp, vice-president of Röhm & Haas; Dr. Gordon M. Kline, chief of Plastics Division, U. S. Bureau of Standards, and technical editor of MODERN PLASTICS; and Dr. Virgil D. Reed, assistant director U. S. Bureau of Census.

In addition to the exhibit of entries in the Competition, there were displays by a number of manufacturers of plastic materials and a small laboratory press was in operation to demonstrate the technique of molding.





HAROLD VAN DOREN



JOHN G. MORGAN



HELEN E. RUNYON



MORRIS B. SANDERS



E. A. FARR



JAY ACKERMAN



LELAND L. BERRY



MAX SILVERMAN



JEAN OTIS REINECKE



LOUIS H. STEINMAN

DESIGNERS OF THE WINNING ENTRIES IN MODERN PLASTICS COMPETITION

INDUSTRIAL

Harold Van Doren designed the Toledo Scale which won first award in this group, while Jean Otis Reinecke was responsible for the appearance of the Burton X-Ray Projector which won second award; and Leland L. Berry engineered the Injection Molded Bezel for the Colonial Radio Corp. which won third award.

DECORATIVE

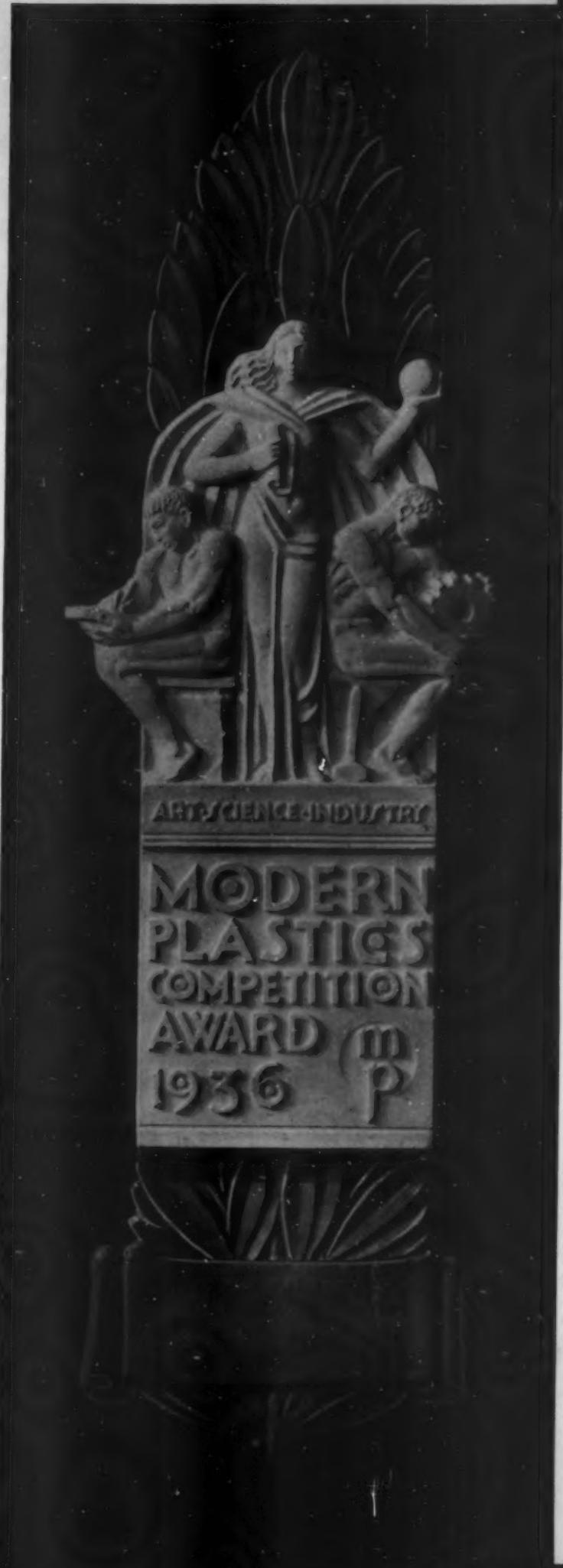
John G. Morgan designed the Sears Roebuck Silvertone Radio which was given first award in this group, and Morris B. Sanders won second award for the design of his own home. E. A. Farr and Jay Ackerman shared efforts and honors in the design of the Manning-Bowman Iron which won third award.

STYLE

Helen E. Runyon, who is not a professional designer—but a secretary with practical ideas, designed and made the Revolite Evening Cape which won first award. Max Silverman was responsible for creating the Lumarith Beach Hat which won second award; and Louis H. Steinman designed and manufactured the "Jane Pickens" Bag which won third award.

Honorable mention

awards



THE EXCEEDINGLY PRACTICAL and ingenious applications of plastic materials entered in our First Annual Modern Plastics Competition were baffling to the judges in each group. With but three awards originally planned for each group, the decisions of the judges were made extremely difficult. Therefore, on the following pages we present those entries to which additional Honorable Mention Awards have been made.

style group



TOILET SET BY DU PONT

To E. I. du Pont de Nemours & Co., Inc., Plastics Dept., New York City, for Pyralin Dresser Set designed by A. S. Donaldson. Both the material, Pyralin, and the set itself were made by du Pont. The metal inlays used for decoration were made by the Attleboro Art Co., Attleboro, Mass.

To Nat Lewis Purses, Inc., New York City for Purse with decorative Plastic Bar Top and Fastening designed by David Lewis. The plastic is Pyralin made by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and fabricated by William Walicki, Brooklyn, New York.

BAG BY NAT LEWIS



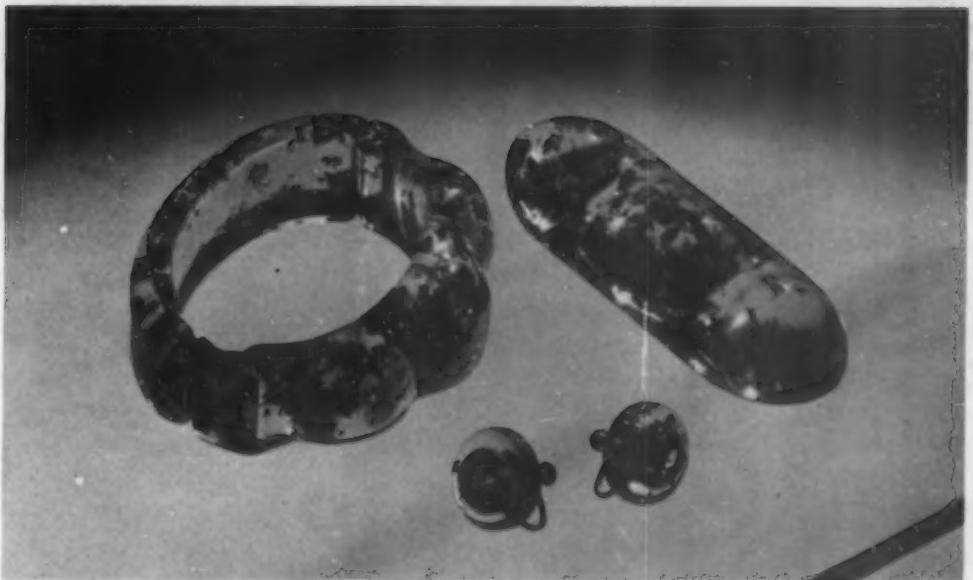
To Shields Inc., New York City, for Transparent Cigaret Case designed by Michael Rosenblum. The case is manufactured by Shields Inc., Attleboro, Mass., using Catalin supplied by American Catalin Corp., New York City.

To Cahn & Co., New York City, for set of gold flecked Costume Jewelry designed by Walter Heimler. The material is Catalin, made by the American Catalin Corp., and fabricated by Charles Gottlieb & Sons, both of New York City.

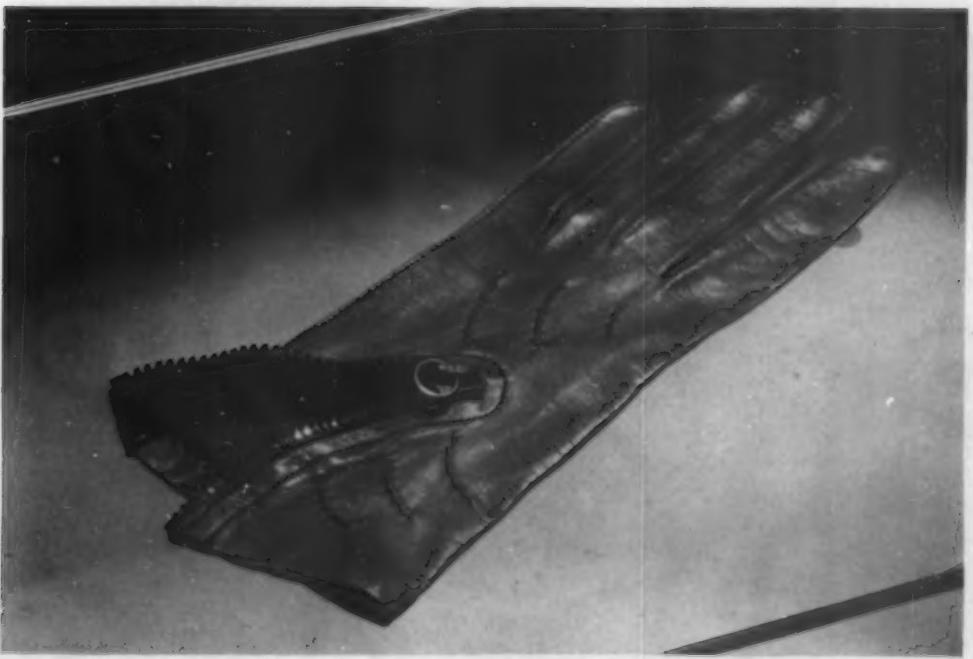
To Lewis Meyers & Son, Inc., New York City, for Glove with Plastic Talon Fastener in matching color designed by Marinette Blanc. The plastic is Pyralin made by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., and fabricated by Hookless Fastener Co., Meadville, Pa.



CIGARET CASE BY SHIELDS



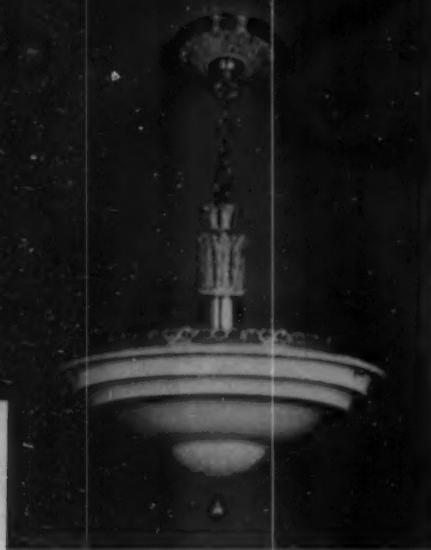
GOLD FLECKED JEWELRY BY CAHN



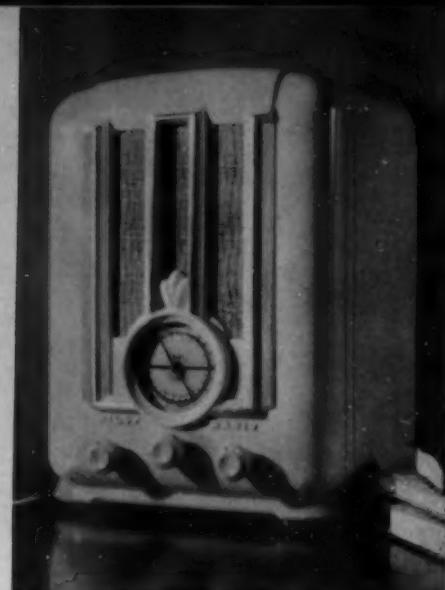
GLOVE WITH TALON
FASTENER BY
MEYERS & SON

mention awards decorative group

Honorable



LIGHTING FIXTURE BY CHASE



RADIO BY PILOT



LAMP BY MUTUAL SUNSET

To Chase Brass and Copper Co., Waterbury, Conn., for overhead Lighting Fixture designed by staff designers. The translucent bowl reflector was molded by Bryant Electric Co., Bridgeport, Conn., from Beetle, a molding compound made by Beetle Products Div. of American Cyanamid Co., New York City.

To Pilot Radio Corp., Long Island City, N. Y., for Radio designed by Jan Streng. The cabinet was molded by Associated Attleboro Mfg. Co., Attleboro, Mass., from Beetle manufactured by Beetle Products Div. of American Cyanamid Co., New York City.

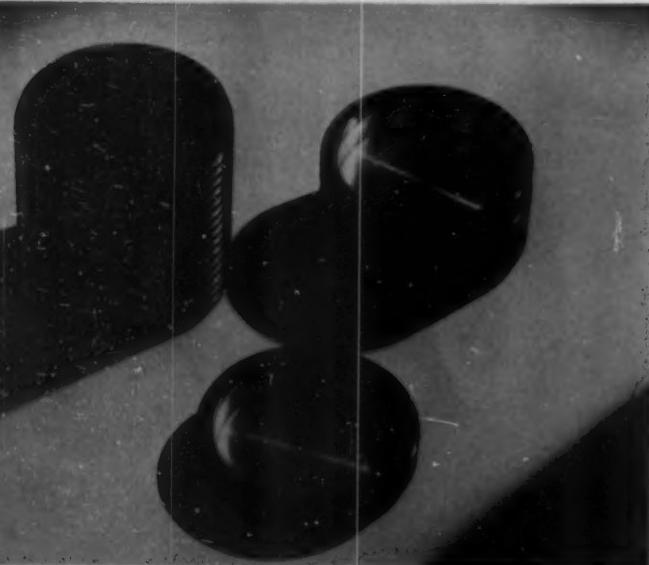
To Mutual Sunset Lamp Mfg. Co., New York City, for Lamp with Matching Shade designed by M. J. Horgan. The shade was fabricated by the Mutual Sunset Lamp Mfg. Co., from Lumarith manufactured and grained to match the base of the lamp by the Celluloid Corp., New York City.

To Hurst, Inc., Boston, Mass., for combination Cigaret Dispenser and nest of Ash Trays which stack neatly together when not in use. The plastic is Catalin made by the Catalin Corp., New York City.

To Sparklets Corp., New York City, for Soda Water Bottle designed by Lawrence B. Ward. The chromium bottle has a complete top molded by Boonton Molding Co., Boonton, N. J., of black Plaskon made by Plaskon Co., Inc., Toledo, Ohio

To Elod Corp., Essex, Conn., for Molded Lamps with Lumarith Shades and Pedestal Panels designed by Robert J. Hill and George J. Rametta. Materials used were Beetle manufactured by Beetle Products Div. of American Cyanamid Co., New York City, and Plaskon made by the Plaskon Co., Inc., Toledo, Ohio. The molding was done by Gorham Co., Providence, R. I.

NESTED TRAYS BY HURST





SYPHON BY SPARKLETS



TWO LAMPS BY ELOD

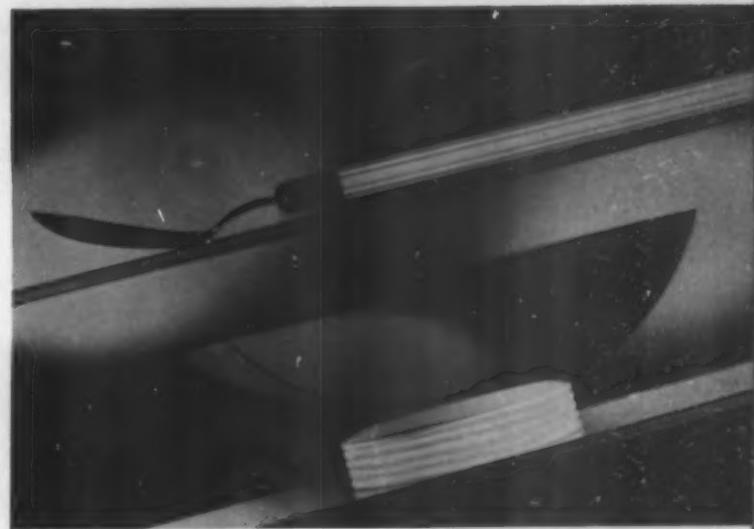
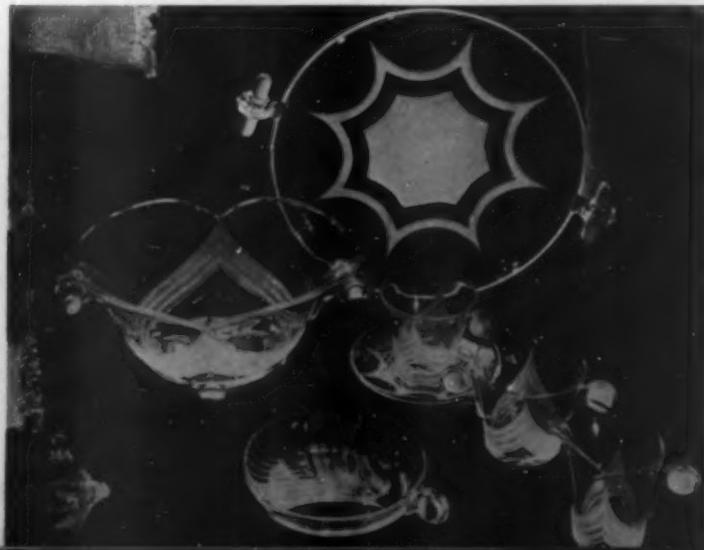


To Chase Brass and Copper Co., Waterbury, Conn., for Berry Bowl and Serving Spoon designed by staff designers. The chromium bowl has a base fabricated by Plastic Turning Co., Leominster, Mass., of Catalin made by the Catalin Corp., New York City. The chromium spoon also has a Catalin handle.

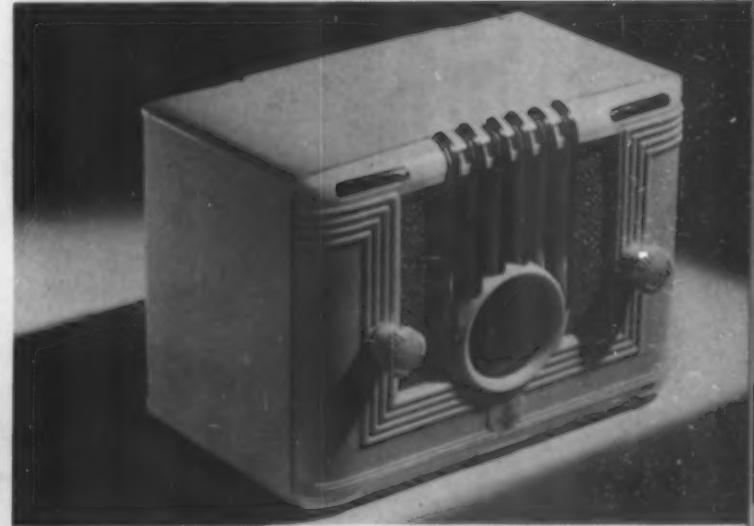
To Emerson Radio Corp., New York City, for Radio designed by the Emerson staff. The cabinet was molded by Associated Attleboro Mfg. Co., Attleboro, Mass., of Beetle made by Beetle Products Div. of American Cyanamid Co., New York City.

To A. H. Heisey & Co., Newark, Ohio, for group of Glassware with Plastic Handles designed by Walter von Nessen. The handles are Plaskon manufactured by the Plaskon Co., Inc., Toledo, Ohio, and molded by Plastic Molding Corp., Sandy Hook, Conn.

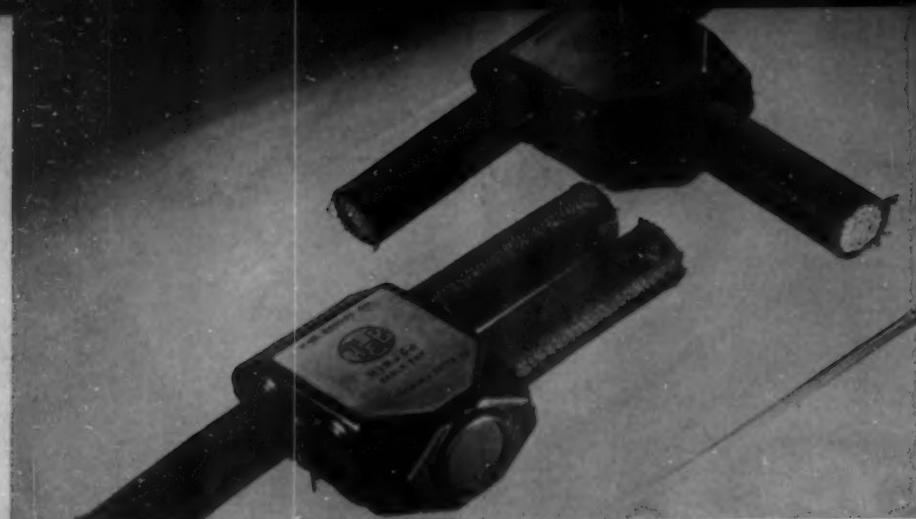
GLASSWARE BY HEISEY



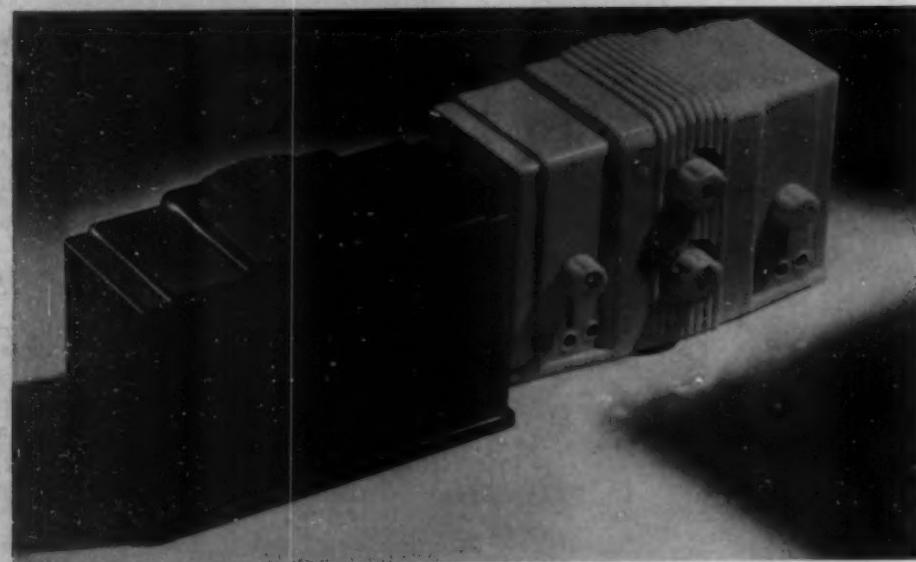
BOWL AND SPOON BY CHASE



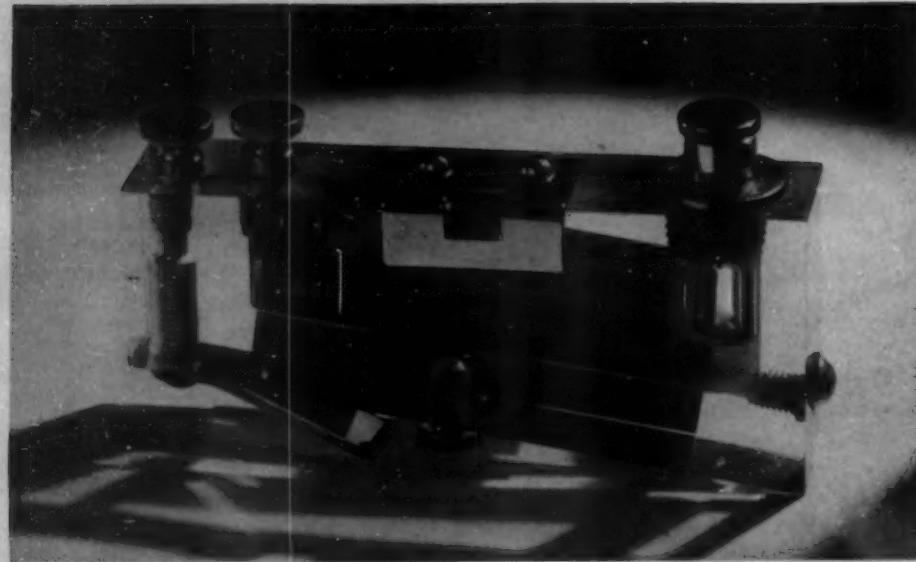
RADIO BY EMERSON



HINJON TAP COVERS
BY THOMAS & BETTS



CAUTERY BY
COMPREX OSCILLATOR



POCKET DRAFT GAGE
BY STANDARD OIL



TOOLS BY FORSEBERG

Honorable mention

To The Thomas & Betts Co., Elizabeth, N. J., for "Hinjon" Tap Insulating Covers designed by L. H. Church and C. A. Badeau. These housings are molded of Textolite by General Electric Co., Plastics Dept., Bridgeport, Conn.

To Comprex Oscillator Corp., New York City, for the Comprex 10th Anniversary Model Cautery designed by H. S. Rubens. The cabinet is molded of black Bakelite made by Bakelite Corp., New York City, also of white Unyte, made by Plaskon Co., Inc., Toledo, Ohio. The pilot-light cover and control knobs are molded of Tenite made by the Tennessee Eastman Corp., Kingsport, Tenn., by the Boonton Molding Co., Boonton, N. J.

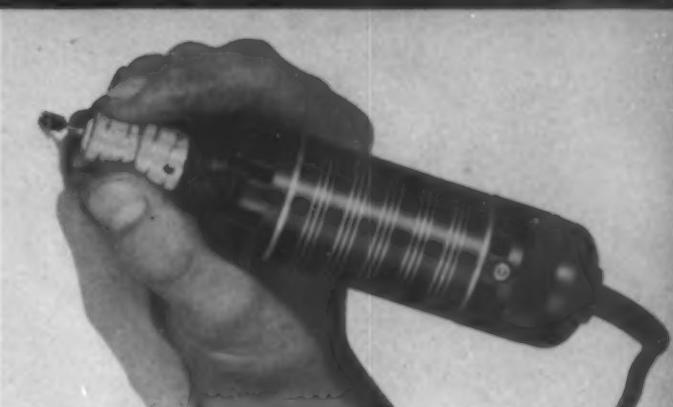
To Standard Oil Co. of Indiana, Chicago, Ill., for Pocket Inclined Draft Gage designed and fabricated by F. W. Dwyer Mfg. Co., Chicago, Ill. The transparent body of the gage is cast resinoid manufactured by Bakelite Corp., New York City.

To Forseberg Mfg. Co., Bridgeport, Conn., for tools with handles of tough and highly insulative plastics. Handles are made of Lumarith by the Celluloid Corp., New York City.

To Chicago Wheel & Mfg. Co., Chicago, Ill., for De Luxe Hand-ee Grinder designed by Loyd Scruggs. The light weight rugged construction necessary to the success of this instrument was made possible by molding the housing of Bakelite, manufactured by the Bakelite Corp., New York City. Molding was done by Midwest Molding Co., Chicago, Ill.

To Transducer Corp., New York City, for Bullet Electro-dynamic Microphone designed by G. M. Giannini. The double curved shell is molded in

FARE REGISTER COVER
BY CHICAGO SURFACE LINES

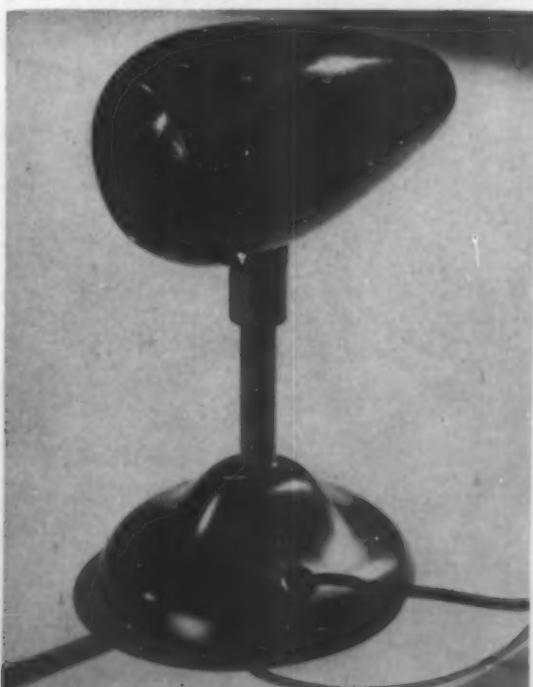


HAND-EE GRINDER BY
CHICAGO WHEEL CO.

four press operations by Accurate Molding Co., Brooklyn, N. Y., from black Bakelite made by Bakelite Corp., New York City.

To Chicago Surface Lines, Chicago, Ill., Fare Register designed by L. M. Traiser and W. B. Petzold. The main cover and toggle housings are of Tenite made by the Tennessee Eastman Corp., Kingsport, Tenn. The removable transparent window and light compartment separators are of Fibestos made by the Fiberloid Corp., Indian Orchard, Mass. The molding was done in the Fort Wayne Plant of the General Electric Company, Plastics Divisions.

STREAMLINE MICROPHONE
BY TRANSDUCER CORP.



MOLDED



THE white Plaskon Toledo Scale housing and the ivory Plaskon Silvertone Radio cabinets were awarded First Prizes in the Modern Plastics Competition. To the men responsible for designing and engineering these winners goes, naturally, major credit for that accomplishment. The part played by Molded Color—the material they chose above

all others—is evident in the winners' practical, permanent beauty.

Plaskon is the fastest growing molding material in point of volume and in point of the number of applications. Why has it won this preferential position? Because Plaskon offers fine molding qualities, fine structural qualities, fine wearing qualities, a permanent finish

COLOR



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CANADIAN AGENTS: CANADIAN INDUSTRIES LIMITED, MONTREAL, P. Q.



New Hoover One Fifty Cleaning Ensemble designed by Henry Dreyfuss, combines for the first time in household design magnesium, the airplane metal, and molded phenolics

THE HOOVER ONE FIFTY

by K. O. TOOKER AND F. L. PIERCE

Staff Engineers, The Hoover Company

In which molded plastics are used with aluminum and magnesium alloys for lightness of weight, permanence of finish, and all around efficiency in operation

THIS MONTH THE NEW HOOVER ONE FIFTY Cleaning Ensemble made news. For the first time in ten years something basically new in vacuum cleaner principle, design and construction was introduced. This model was not born overnight. It took three long years of development in which the requirements were: 1. modern appearance, 2. light weight, 3. improved performance, and 4. new convenience features.

Henry Dreyfuss, noted designer, was called upon to offer his ideas for a new appearance design and the Engineering Department of The Hoover Company developed the design for production. The design submitted by Mr. Dreyfuss represented a complete change in the traditional Hoover lines. The cleaner is distinguished by smooth contours, which conceal all accessory devices. In order to carry out the objectives of modern appearance, light

weight and improved performance it was necessary to employ the newer materials of industry—molded plastics, aluminum alloy and magnesium alloy.

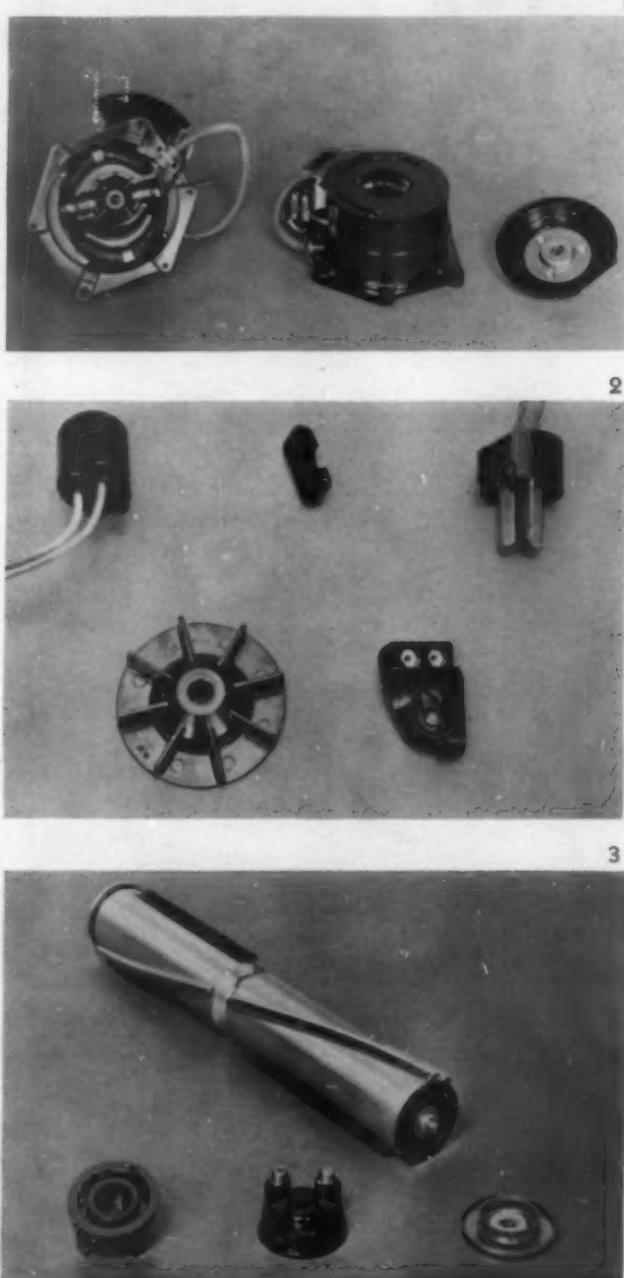
There are a total of eleven molded parts, totaling 1.75 pounds in weight. Two parts weighing .40 pounds are used in the associated set of cleaning tools. The new model is twenty per cent less in weight than the previous model. The motor hood, motor case, ventilating fan, agitator ends, bag connector, and other small parts are of molded Bakelite, a material of about half the weight of aluminum. The body of the machine, as well as the chassis, bottom plate, fan, and handle bail are made of die-cast magnesium alloy, a metal one-third lighter than aluminum.

In addition to the lightness in weight afforded by molded plastics, the molded parts have permanent color

and luster, electrical insulating properties, and permit greater freedom in design. The advantage of greater freedom in design is important in that complex shapes are more easily obtained with molded plastics than with stampings. Very careful tests were made to insure adequate strength for all parts, each molding being the result of a development program involving several preliminary designs. Special molding materials were used to secure certain properties in individual parts.

The unique molded hood was produced from a special extra-strength material developed for this part, which in combination with the reinforced ribbing on the inside, produced a rugged molding that will withstand more than ordinary abuse. Similarly, molding material having greater shock resistance and capable of withstanding knocks was employed for the molded dusting tool parts. This material buffs easily to a fine finish.

The molded plastic for the (*Continued on page 62*)



4

1. A molded motor case holds close dimensional tolerances insuring accurate assembly and alignment of bearings, carbon brushes and field core.
2. Light socket, ventilating fan, handle plug and receptacle are all molded.
3. Hoover agitator has molded ends while the motor hood (4) of the cleaner is molded too

HENRY DREYFUSS SAYS:

"The new Hoover One Fifty cleaner is, I believe, an excellent example of successfully combining good form and function. New in mechanism, form, color, materials and even merchandising, it marks another step forward in the movement toward appearance improvement of strictly utilitarian products."

"Our job in designing the new Hoover was to cooperate with the engineers in matching excellence of appearance to excellence of performance. We were called in to work with them on the design when the new mechanism was still in its swaddling clothes (the ideal time to produce the best design results). With the engineers we took the cleaner through its first steps working on every detail as it developed until it finally received its college degree with honors. This early acquaintance with the problem gave us greater scope for design possibilities and the decision to use materials new to the cleaner—Bakelite and magnesium—gave us even more latitude."

"No detail was considered too small for thorough research and design attention—each was considered a major problem in itself. The handle grip was considered from the standpoint of comfort—the clip-on plug to the cord was designed so as to be able to pull out easily from the socket—the bail, the lettering and the bag as well as the bolts and minor parts were all carefully designed."

"This attention to detail is one of the most outstanding features about the whole design, because our entire object was to make the cleaner and all its component parts—cleaning tools and packages as well—tie up into one complete and harmonious unit."

"The stratosphere grey and blue color combination gets away from the traditional black and silver, and the exact shades of grey and blue were considered and revised time and again through the various models, from plaster to wood and metal models, until we thought we had just the right shades and the right finish."

"The appearance of the One Fifty is the result of unstinting time and thought and expense, and what is even more important, the whole-hearted cooperation of an engineering department that never said to me as a designer, without thorough experimentation, 'It can't be done.'"



GOLF AND RAIN AT LENOX

THE GATHERING of Eastern molders at The Berkshires Hunt and Country Club at Lenox, Mass., on October 7th and 8th was one of the most enjoyable we have attended. That spot at this time of year is glorious to behold and Nature, with its flair for brilliant coloring, arranged a perfect background in the surrounding hills. Although rain dampened some of the golfers on Wednesday, it had no effect on the enthusiastic conversations within the club and the object of the meeting—that of good fellowship for better acquaintance—was well attained, if one can judge by observation.

The dinner on Wednesday evening was informal according to custom. G. Victor Sammet of the Northern Industrial Chemical Co., who had issued the call for the meeting welcomed those present and introduced a distinguished guest, G. Norman Higgs, director of Synplas Ltd., of London. Mr. Higgs was asked to tell the gathering something of his experiences in America which he was visiting for the first time. Near the end of the dinner Gordon Brown of the Bakelite Corporation was called upon to speak. The request came from an anonymous source among the diners. He was accorded such tremendous and spontaneous applause that no one heard what he had to say.

Thursday dawned bright and clear, perfect for golf and ideal to walk or sit around and watch. One by one guests reluctantly drove away, all in accord that this sort of informal organization among molders and materials suppliers is very much worth while.

Among those attending were: K. N. Atwater, Providence, R. I.; D. C. Bateholts, Specialty Insulation Co.;

A. S. Blackinton, Associated Attleboro Mfg. Co.; C. W. Blount, Bakelite Corp.; Gordon Brown, Bakelite Corp.; T. F. Butterfield, Butterfield Co.; G. W. Carlson, Arrow, Hart and Hegemann; W. T. Cruse, Celluloid Corp.; R. H. Cunningham, Bryant Electric Co.; Donald Dew, Diemolding Corp.; C. W. Douglas, Associated Attleboro Mfg. Co.; C. L. Gabriel, Resinox Corp.; H. M. Galey, Makalot Corp.; T. E. Giblin, General Electric Co.; Robert Grant, Jr., Tennessee Eastman Corp.; W. M. Gulliksen, Gulliksen Mfg. Co.; A. W. Hammer, Jr., General Plastics, Inc.; G. N. Higgs, Synplas, Ltd., London N.W., 10, England; W. E. High, Auburn Button Works; G. G. Jeter, General Electric Co.; S. W. H. Jones, Plaskon Co.; W. F. Kaynor, Waterbury Button Co.; Donald Kendall, Mack (*Continued on page 50*)



STOCK HANDLES OF CAST RESIN

SHEET TWENTY-ONE

These cast resin handles are suitable for tableware or other utensils and are available either finished or roughly shaped in a wide range of beautiful colors. Inquiries from interested executives will be promptly forwarded to the manufacturer of these handles.

262. Decorative handle 2 9/16 in. long. Base 5/8 in. diameter. Top, 5/16 in. in diameter

263. Knife handle 4 1/16 in. long and 11/16 in. wide at bottom. 5/16 in. thick. The top has a slightly stepped design

264. Plain oval shaped tapering handle 3 7/16 in. long, 3/4 in. in diameter at base and 1/2 in. diameter at top

265. Oval shaped handle 3 5/8 in. long with a groove 1/8 in. in for inserting. 3/4 in. wide at bottom and 1/2 in. wide at top

266. Tapering handle 3 3/4 in. long and 7/16 in. wide. Thickness at bottom 15/32 in. and at top 13/32 inch

267. Tapered handle 3 3/4 in. long with groove for inserting in ferrule 1/8 in. Width 3/4 in. at bottom. Thickness 3/8 inch

268. Beveled sides and wide center panel distinguish this handle for knives and forks. 3 1/2 in. long, 3/8 in. thick, 3/4 in. wide at base and 1/2 in. at top

269. Handle with wide center panel 3 3/4 in. long and rounded edges at top. 7/16 in. thick and 3/4 in. wide at base

270. Handle with beveled sides and wide center panel, 3 3/4 in. long, 7/16 in. thick and 3/4 in. wide at bottom. Width at top is 9/16 inch

271. Tapering ribbed handle 3 7/16 in. long, 7/8 in. wide and 9/16 in. thick

272. Plain oval handle 2 3/4 in. long, 5/8 in. wide and 5/16 in. thick

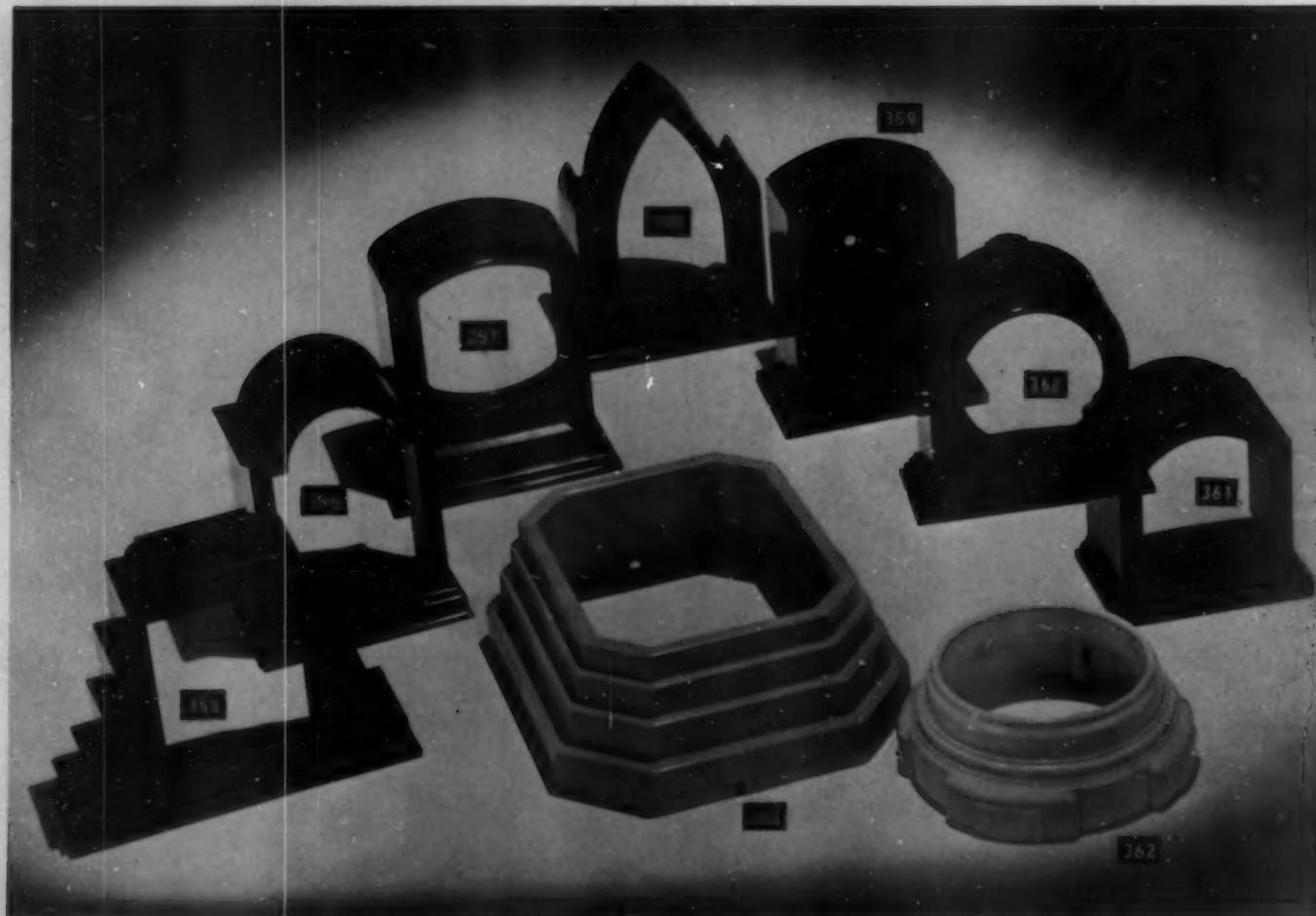
273. Diamond shaped handle 3 5/16 in. long and 7/8 in. wide



Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

Stock molds

SHEET TWENTY-TWO



Here's an additional page of clock cases available from stock molds. The owners of these molds will be glad to send samples to any executives interested. Please specify item and sheet number when inquiring

355. Case 6 5/16 in. long and 2 1/8 in. wide at base. Height 5 1/4 in. (Inside dimensions are given in each case)

356. 3 7/8 in. long by 2 7/8 in. wide by 6 1/8 in. high

357. 4 1/2 in. long by 2 1/2 in. wide by 6 3/8 in. high

358. 4 3/4 in. long by 4 11/16 in. wide by 6 1/2 in. high

359. This case has a back already in place and an opening at the base for inserting the works. 4 in. long, 2 1/4 in. wide, and 5 3/4 in. high

360. 4 1/2 in. long by 2 1/4 in. wide by 5 1/2 in. high

361. 3 3/4 in. long by 3 in. wide by 4 1/2 in. high

362. Round case for use on a wall, 5 3/8 in. in diameter at back, and 2 1/4 in. high

363. Another wall clock case, 9 5/16 in. long by 7 9/16 in. wide by 3 1/16 in. high

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits.

TECHNICAL
SECTION

MODERN PLASTICS



A Vital Part of the Wings of Safety . . .

Plastics by



Photo, courtesy American Air Lines

DURITE HIGH IMPACT
MOLDING MATERIALS



Molded by Molded Insulation Company, Philadelphia, Pa.

For aircraft pulleys, over which pass vital airplane control cables and where failure might mean disaster, the choice of the leaders is Plastics by Durite. For such important pulleys Durite High Impact Molding Material has passed stringent Army and Navy tests and has been adopted for use in their planes. Commercial transport companies likewise specify that their aircraft pulleys be molded of Durite.

Though this is high tribute in itself it is but one of the thousands of applications where Durite Plastics have been the specified choice of leading companies for many years. If you have never had occasion to learn of their advantages, write and ask about these unusual Plastics by Durite, the exclusive producers of phenol-furfural resins.

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DURITE
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A DIVISION OF STOKES & SMITH COMPANY

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4

5

SYMPORIUM ON RESINS AND PLASTICS

by GORDON M. KLINE

RECENT ADVANCES IN THE CHEMISTRY OF plastics, in both its theoretical and applied aspects, were described at the Plastics Symposium held on September 10 as part of the Pittsburgh meeting of the American Chemical Society. Approximately three hundred chemists attended the symposium and many of them took part during the ample discussion periods which followed each paper. A summary of the proceedings is presented below.

Introduction, by S. S. Kistler, chairman of the Colloid Division. In the past one hundred million years or better, forced by uncompromising necessity and guided by evolutionary patterns the nature of which is still unknown, plants and animals have involuntarily learned how to couple small molecules together into immense units and to so pack them together as to form structural materials of extraordinary properties unapproached by anything in the inorganic world. Man, in the conquest of his environment early learned to appreciate and utilize some of these products, such for instance, as wood, leather, and the textile fibers, but only within the past thirty years have the chemical arts attained the skill to consciously produce organic materials for construction rivaling the natural products. As might be expected, the commercial importance of these new products, the synthetic resins, was from the beginning so large that the art of their production has been most assiduously cultivated by industrial concerns, while their complexity has been such as to deflect the attention of academic men from them. It was with the realization that there lies within the files of many companies and in the experience of many commercial chemists an immense amount of information that could be exchanged with harm to none and much profit to many, that an invitation was issued to resin chemists to participate in this symposium.

The Kinetics of the Ammonia Catalyzed Phenol-Formaldehyde Reaction, by Birger W. Nordlander. Two stages of the phenol-formaldehyde reaction are recognized: (1) the primary reaction, in which phenol and formaldehyde react to form water-soluble intermediates of the oxymethylene phenol type; (2) the secondary reaction, in which these intermediates react further by condensation to give water-insoluble resinous products. The primary reaction is confined to the interaction of one mol of formaldehyde with one mol of phenol; no formaldehyde reacts with any of the intermediates formed. This reaction is of apparent monomolecular order, the rate being proportional to the concentration of free phenol. The influence of the catalyst is complex; apparently both hydrogen and hydroxyl

ions and probably also other ions derived from the catalyst promote the reactions. At very low ammonia concentrations the reaction order changes into one of apparent bi-molecular type, characterized by a reaction rate proportional to the square of the formaldehyde concentration. The secondary reaction is of an apparent mono-molecular order. The catalytic effect is again complex and similar but not identical to that governing the primary reaction. When the catalyst is a weak alkali, like ammonia, phenol does not take part in the secondary reaction, which then is limited to the oxy-methylene phenols and the straight chain hydroxy-phenylene-methylene polymers possessing terminal oxy-methylene groups. A given catalyst affects the primary and secondary reactions to a different extent. The temperature coefficients differ for the two reactions, the secondary reaction rate increasing much more rapidly with the temperature than the primary reaction rate.

The Chemistry and Reaction of Terpene-Maleic-Anhydride Resins, by Edwin R. Littmann. The formation of the terpene-maleic-anhydride resin bases is an industrial application of the well-known Diels-Alder diene synthesis. The so-called "normal" diene synthesis involves the addition of a compound containing an alpha-, beta-unsaturated carbonyl group to a conjugated diene with the formation of a cyclic derivative. The "abnormal" synthesis produces compounds of the linear polymer type previously obtained from anhydrides and polyhydric alcohols and without cyclization. The synthesis of a terpene-maleic-anhydride resin base involves both the normal and abnormal types. While the diene synthesis is ordinarily considered as taking place only with a diene having conjugated double bonds, this need not always be so, since reactions of the "abnormal" type require only the presence of a hydrogen which can migrate with ease. The terpene-maleic-anhydride resin bases are essentially acid anhydrides and as such form alkyd resins having some unique and desirable properties, such as higher melting point, increased hardness, and improved compatibility with oils. The improved properties of these resins may be attributed to the structure of the resin base which is essentially an anhydride grouping attached to a heavily weighted bicyclic terpene residue containing one double bond. Preliminary evidence indicates that, in common with terpenes generally, the alkyds prepared from terpene-maleic-anhydride bases tend to accelerate drying and film formation when used in compositions containing drying oils.

The Constitution of Polysulfide Rubbers, by S. Maner Martin, Jr. and J. C. Patrick. (Continued on page 67)

METHACRYLATE RESINS

by H. R. DITTMAR

E. I. du Pont de Nemours & Co., Inc.



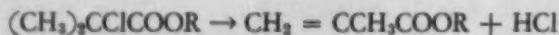
Flowers molded in a solid transparent ball

ALPHA-METHYL ACRYLIC ACID AND SOME of its derivatives have been known for many years,^{1,2} but it has been only recently that recognition of the unique properties of the methacrylic ester polymers has stimulated the studies which have led to their commercial development. Although methacrylic acid, its salts, amide, imide, nitrile, chloride and anhydride have been studied, the esters are of particular interest because they can be polymerized to thermoplastic resins possessing unusual clarity and stability.

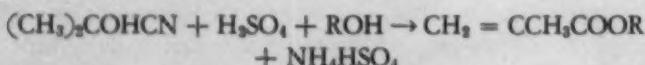
Properties and synthesis of monomeric methacrylates

Methyl methacrylate monomer is a volatile liquid of low viscosity. The physical properties of this compound are summarized in Table 1, and the boiling point and density of a number of typical monomeric higher ester methacrylates are shown in Table 4.

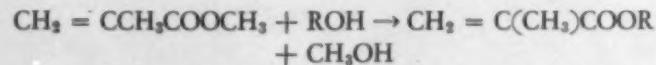
The earlier work on the synthesis of methacrylates has been reviewed by Neher.³ Methacrylic acid esters can be prepared by dehydrohalogenating alpha or beta halogenated isobutyric esters:³



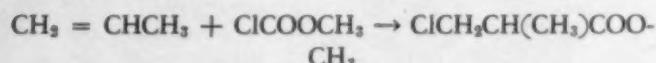
or from acetone cyanhydrin:⁴



The synthesis of higher ester methacrylates is conveniently carried out by alcoholysis with the methyl ester monomer:



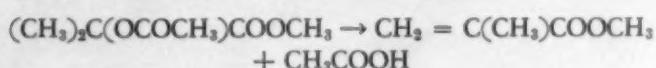
Izard⁵ has prepared methyl methacrylate by condensing methyl chloroformate with propylene to methyl-chlor isobutyrate and its dehydrohalogenation to methyl methacrylate:



while Reid⁶ has obtained chloroisobutyril chloride from propylene and phosgene. Esters of methacrylic acid were then prepared by esterification and dehydrochlorination:



Methyl methacrylate has been obtained in good yields by the pyrolysis of methyl alpha-acetoxy isobutyrate:⁷



Polymerization

Methacrylic acid ester polymerization is autocatalytic, being catalyzed by heat, light, ozone and oxygen.

The square blocks are molded, the rest are cast. The ball is turned from a cast rod



Ozonides and peroxides such as benzoyl, acetyl and hydrogen peroxides are vigorous catalysts. In the absence of oxygen and light at temperatures up to 100° C. the polymerization of methyl methacrylate practically stops after a small fraction of the monomer has polymerized. Oxygen appears necessary below 100° C. for polymerization to approach completion under the above conditions.

This has been demonstrated experimentally. Carefully purified methyl methacrylate monomer was fractionated at 25–30 mm. in an atmosphere of dry, oxygen-free nitrogen and the middle fraction transferred to a flask of an all-glass apparatus containing the triphenyl methyl to remove traces of peroxides. This apparatus had been previously carefully cleaned, and absorbed gases and water removed by a vacuum bake. After remaining overnight protected from light in contact with triphenyl methyl, the ester was fractionated. The middle portion was collected in 30 cc. pyrex tubes which were sealed off directly or after the introduction of a measured pressure of oxygen gas. These reaction tubes were then placed in a thermostat for polymerization in the absence of light. The degree of polymerization at any one time was determined by dissolving the weighed sample in acetone and precipitating the polymer with methanol, then drying to constant weight at 90 – 100° C. in a vacuum oven. It was first shown that 99% of the polymer could be recovered in this manner.

The data obtained at 65° C. in the absence of light are plotted in Fig. 1. In the absence of oxygen only a very small part of the monomer polymerizes even after 620 hours. It is probable that the slight polymerization taking place was caused by traces of unremoved catalytic material and it can probably be assumed that at 65° C. no polymerization will take place in the complete

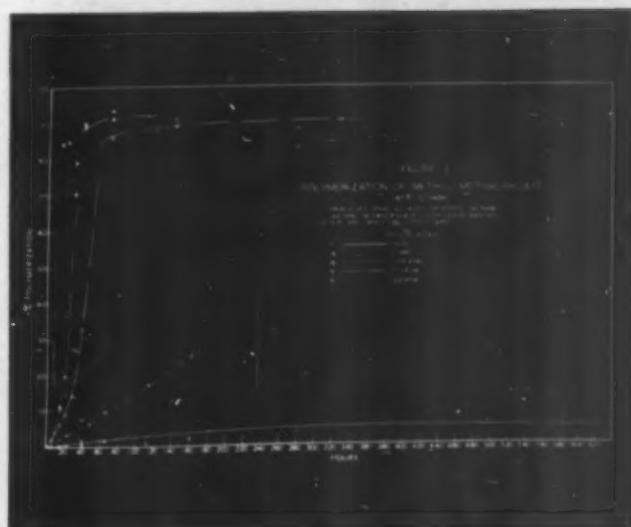
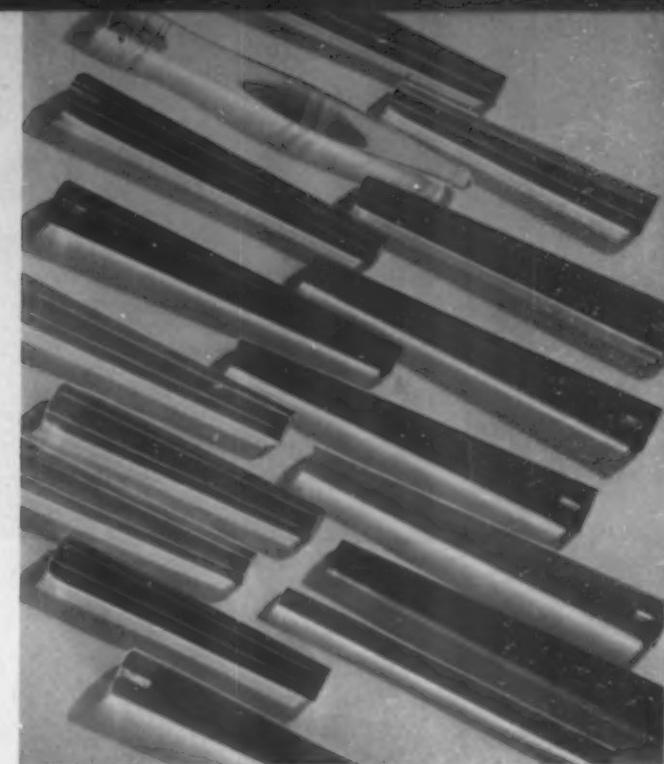


FIG. 1

Top—Showing various handles of Pontalite pressure molded. Left—Showing the same material cast with the two small pieces at the left carved in pattern. Fig. 1 shown directly above is referred to in the text

absence of oxygen and light. The addition of as little as 0.01 atmosphere of oxygen definitely catalyzes the polymerization, while the velocity is markedly increased by the presence of 0.1 atmosphere of oxygen. In Fig. 2 are given the data obtained at higher temperatures under the catalytically pure conditions described. At 100° C. the polymerization rate is essentially the same as at 65° C. during approximately 400 hours. At 170° and 210° C. the reaction proceeds relatively rapidly, even without oxygen and light.

The catalyzing effect of temperature, oxygen and light is summarized in Table 2. These data were determined from curves similar to those shown in Figs. 1 and 2. The influence of light was obtained by arranging several of the sealed tubes on the circumference of a 40 cm. diameter circle in the center of which was a 125 watt lamp.

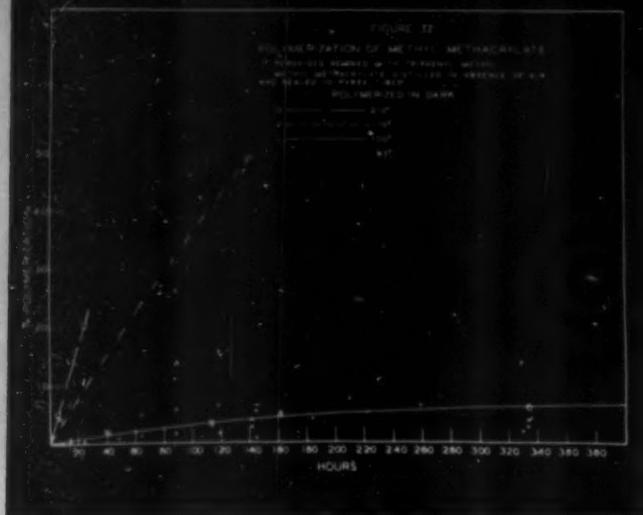


FIG. 2

Extraneous light was excluded by protecting the apparatus with a black cloth. The heat emitted from the lamp was sufficient to maintain the methyl methacrylate at about 35° C. Although the effect of light was only determined at 35° C., a definite acceleration of the polymerization is observed.

The results described above resulting from the absence of oxygen are not normally encountered because the monomeric methacrylates as prepared contain traces of

TABLE 1—PROPERTIES OF MONOMERIC METHYL METHACRYLATE

Specific Gravity—60°/60° F.....	0.9497
Refractive Index—60° F./D.....	1.4168
B. P.—° C.—760 mm.....	100.3
200 mm.....	61
100 mm.....	46
M. P.—° C.....	—48
Relative Viscosity—22° C.....	0.588
Latent Heat of Vaporization—765 mm.....	77 cal./gm.
200 mm.....	88 cal./gm.
Specific Heat.....	0.49 cal./gm./° C.
Solubility—Soluble in typical organic solvents; insoluble in water and formamide; slightly soluble in glycerol and ethylene glycol.	

TABLE 2—EFFECT OF OXYGEN, TEMPERATURE AND LIGHT ON THE POLYMERIZATION OF METHYL METHACRYLATE

Temp.	O ₂ Pressure	Time in Hours for Polymerization		
		Atm.	1st 5%	1st 25%
30° C.	0.0	>300		
	0.1	300		
	1	>300		
65° C.	0.0	200		
	0.1	14	35	13
	1	10	22	8
100° C.	0.0	200		
	0.1	1	2.8	1.8
	1	0.75	1.2	0.5
170° C.	0.0	13	68	70
210° C.	0.0	6	32	
Light at 35° C.	0.0	240	450	
	0.1	41	75	14
	1	92	108	12

TABLE 3—PROPERTIES OF UNPLASTICIZED POLYMERIC METHYL METHACRYLATE

General	
Density—25° C.....	1.19 to 1.20
Hardness—Brinell Scale.....	25-28
Softening Temperature—° C.....	80-125
Shrinkage of Molded Resin—Inches/In.....	.003-.005
Water Absorption—%.....	About 0.5 or less
Mechanical	
Tensile Strength—Lbs./Sq. In.....	8,000-11,000
Impact Strength (A.S.T.M. Notched), Ft./Lbs.....	0.23-0.27
Modulus of Elasticity—Lbs./Sq. In.....	2.3-3.0 × 10 ⁶
Fiber Stress—Lbs./Sq. In.....	13,000-18,000
Thermal	
Thermal Conductivity—BTU/Sq. Ft./Hr./° F./In.....	1.25
Coefficient of Linear Expansion.....	8.2-9.5 × 10 ⁻⁵
Optical	
Refractive Index.....	1.482-1.521
Light Transmission.....	95%*
Ultraviolet Transmission (0.01" Film).....	To 2,500 Å.
Light Stability.....	Perfect
Internal Reflectability.....	Good
Electrical	
Volume Resistivity—Ohms/Sq. Cm.....	2.0-3.0 × 10 ¹²
Dielectric Constant (60 Cycles)—25° C.....	3.3-4.5
100° C.....	5.0-6.0
Power Factor (60 Cycles)—%—25° C.....	6.5-8.0
100° C.....	1.0-4.0
Dielectric Strength (in oil at 100° C.)	
Insulation Thickness, Inches	Dielectric Strength, Volts/Mil
0.054	741
0.063	687
0.092	615
0.245	347
Arc Resistance.....	Does not track
Inflammability—Slow burning	
Solubility	
Soluble in	Insoluble in
Esters	Water
Ketones	Aliphatic Alcohols
Aromatic Hydrocarbons	Lower Aliphatic Ethers
Chlorinated Hydrocarbons	Aliphatic Hydrocarbons
Anhydrous Organic Acids	Vegetable Oils
	Glycols
	Carbon Tetrachloride
	Formamide
	Phosphoric Acid (70%)
	Hydrochloric Acid (30%)
	Sulfuric Acid (60%)
	Aqua Ammonia
	Sodium Hydroxide (30%)

*—Delmonte, *Modern Plastics*, 13, 15 (1936).

Cast Ponalite rods of different diameters and lengths

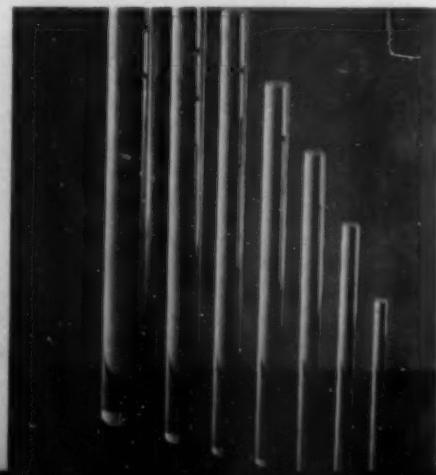


TABLE 4—PROPERTIES OF METHACRYLATE ESTERS

Methacrylate	B. P., ° C.	Monomer Mm.	Density 20	Polymer-Molded Disc	
				Softening Temp., ° C.	Description
Methyl	100.3	760	0.945	125	Clear, hard, strong
Ethyl	116.5-117	760	...	65	Clear, tough
n-Propyl	141-143	765	0.921	38	Clear, tough, flexible
Isopropyl	125	760	0.888	95	Clear, strong
n-Butyl	51-52	11	0.894	33	Clear, flexible, strong
Isobutyl	46-47	13	0.884	70	Clear, slightly brittle
Sec. Butyl	53-57	18	0.890	62	Clear, slightly brittle
Tert. Amyl	67-68	20	0.887	76	Clear, brittle
Diisopropyl Carbinol	72-75	9	0.876	60	Clear, very brittle
Octyl	105	5	...	<R. Temp.	Clear, gel
Lauryl	142	4	...	<R. Temp.	Clear, viscous liquid
Phenyl	83-84	4	1.053	120	Clear, very brittle
o-Cresyl	98-103	5	1.031	106	Clear, very brittle
Cyclohexyl	71-74	5	0.959	105	Clear, slightly brittle
p-Cyclohexyl Phenyl	M. P. 67-68	145	Hazy, brittle, very hard
Furfuryl	80-82	5	1.055	78	Brown, hard and brittle
Tetrahydrofurfuryl	81-85	4	1.039	60	Transparent, brittle
β-Chloroethyl	61-64	11	1.106	68	Clear, colorless, tough
β-Phenyl Ethyl	110-117	5	1.018	40	Clear, slightly brittle
β-Methoxy Ethyl	65-67	10	0.990	30	Clear, tough
β-Ethoxy Ethyl	91-93	35	0.966	<R. Temp.	Clear, rubbery
Ethylene Glycol Mono	85-86	5	1.079	70	White, slightly brittle
Ethylene Glycol Di	83	2	Infusible, insoluble solid
Alpha-Methyl Allyl	57-59	15	0.921	...	Infusible, insoluble solid

oxygen and are polymerized in the presence of air; consequently, enough oxygen is always present to induce polymerization.

The methacrylate esters can be cast-polymerized directly into solid, glass-like resins in any desired shape in predesigned molds,⁸ or can first be polymerized in finely divided form⁹ which can be used as a molding powder and molded in any manner suitable for a thermoplastic resin. Rapidly polymerized preforms can also be used for molding.¹⁰

The pure monomeric esters are quite stable and can be stored cool for months without polymerization. Methacrylic acid derivative polymerization is inhibited by traces of hydroquinone, pyrogallol and antioxidants of this general type. For prolonged storage at room temperature, traces of these materials are usually used.

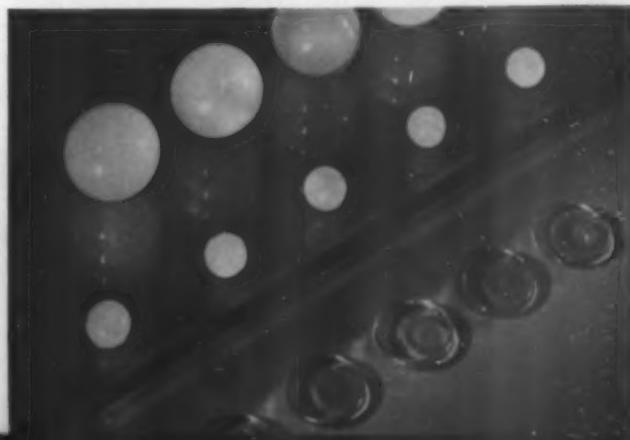
Properties of polymers

Methyl methacrylate polymer is an unusual resin.¹¹ Table 3 summarizes its general properties. In addition to unique clarity, this resin has a high softening temperature, high tensile and impact strengths, good dielectric properties, low specific gravity, perfect light stability, good ultraviolet transmission and is unattacked by the usual inorganic reagents and some of the more common organic solvents. These properties make methyl methacrylate an outstanding plastic. Further, the material can be easily molded and either the molded or cast form can be readily worked. It can be sawed, cut, blanked, turned, drilled, formed, swaged, ground, polished, sanded and routed in much the same manner as nitrocellulose plastics. Although the resin is softer

than glass, it is more scratch-resistant than most other thermoplastics. One can readily restore the original brilliance of a scratched surface by a simple and rapid polishing procedure.

The polymers formed from methacrylic acid esters of the higher monohydric alcohols are similar in chemical properties to polymethyl methacrylate. In the aliphatic series one outstanding difference is the plasticity. As the molecular weight of the alcohol is increased, the softening point of the resin decreases. This is illustrated by the examples given in Table 4, which describes the properties of some typical higher esters. The plasticity, as measured by the softening temperature, increases as the molecular weight of the alcohol decreases, lauryl methacrylate polymer, for instance, being a viscous liquid. The effect of the structure of the alcohol group is shown by the properties of the butyl methacrylate polymers. The plasticity of the isobutyl and secondary butyl ester polymers is less than the normal butyl. The effect of an alcohol containing a carbocyclic or heterocyclic ring is to give a harder (*Continued on page 58*)

Buttons, buckles and other artifacts may be turned from rods of Pontalite



NEW CONSTRUCTION MATERIALS AND TECHNIQUES

Abstract of a talk on plastics given by G. M. Kline at a meeting of the Federation of Architects, Engineers, Chemists, and Technicians, Washington, D. C., on October 5, 1936

THE ORGANIC PLASTICS HAVE BECOME FAMILIAR to everyone because of the multitudinous useful objects fabricated from them which are found in every modern home. Radio housings, French phones, and electrical devices molded of phenol-formaldehyde resin, bright colored clock cases, table accessories and bathroom fixture of urea-formaldehyde resin, vanity sets and powder containers of cellulose nitrate, lamp shades and pen and pencil sets of cellulose acetate, buttons and buckles of casein—these are but a few of the plastic products which we make use of from day to day. Plastics now stand at the threshold of another large outlet for their application in the home and in the building industry in general. In laminated form a large potential field in the use of these materials for interior and exterior trim is being developed and several new manufacturing units have been organized recently to meet the growing demand. Outstanding installations have been made in theaters, hotel lounges and bars, banks and aboard the Queen Mary, and extensive use of the material is to be made in the Library of Congress annex at present under construction.

It is of interest, therefore, to consider the method of manufacturing laminated plastics, the advantages which they offer as a building material, and the various purposes for which they have been used.

A laminated plastic is made up of a fibrous filler in sheet form, such as paper, linen and canvas, and a resin binder, usually of the phenol-formaldehyde type. The individual sheets of filler are impregnated with a solution of the resin, dried, and a sufficient number pressed between steam heated platens in a hydraulic press to give a hard, dense product of the required thickness. Usually a relatively thin sheet of the laminated plastic is applied as a veneer over a less expensive base of pressed board or plywood.

The outstanding advantages which the laminated plastics offer as building materials are superior properties, attractive decorative possibilities, ease of prefabrication and simplicity of application. The properties which have been of prime importance in the selection of these plastics by architects and builders are their unusual resistance to wear and to corrosion by moisture, acids, alcohols, alkalies, and other deteriorating agents, their excellent mechanical strength and their dimensional stability. They are available in a practically unlimited range of colors, which go through to the subsurface layers, and the permissible choice of transparent, translucent, mottled, or opaque finishes makes possible a va-

riety of decorative effects. Prefabrication at the factory with no period of seasoning nor additional treatment to protect the product against corrosion are noteworthy features of the material. The simplicity of installation which requires only one craftsman, a carpenter (and the complete absence of obnoxious odors or of the possibility of chance spotting or staining) enables modernization to be accomplished during those hours of the day in which the establishment is normally closed.

Most of the applications of laminated plastics can be attributed to the smart atmosphere which they create. They have been installed in restaurants, bars, cocktail lounges, department stores, hospitals and hotels as table and counter tops, for which their warmth, resistance to staining, cigarette-proofness and noise-deadening characteristics are decidedly advantageous. Many theaters, hotels, and banks have used laminated plastics for wall and ceiling paneling because of their attractive appearance, durable finish, and ease of cleaning. The use of laminated plastics for doors achieves both beauty and permanence. Where regulations require fireproof construction this can be attained without limiting the architect in choice of color or design on the face of the door. Exterior applications have not been as extensive as those for interior decoration. However, store front bulkheads and display signs have been constructed of this material by progressive manufacturers who wished to reach a potential market in which style and smartness would be assets. The resistance to moisture, lack of any tendency to crack because of sudden changes in temperature and the retention of the original finish indefinitely have been cited as major advantages of the laminated product for such purposes. The architectural uses of laminated plastics in the home and club, office and public building may be expected to be markedly extended as the tendency grows to modernize our surroundings to obtain beauty, simplicity, and utility.

Readers are invited to send their questions to this department for free advice and technical information. No publicity is given to those firms who take advantage of this service. Your letters should be addressed to Dr. Gordon M. Kline, associate technical editor, c/o Modern Plastics, 425 Fourth Avenue, New York City, and a stamped, envelope should be enclosed for your reply.



TENITE

ferrules solve a problem in golf club design at a point where extreme toughness, resilience, and resistance to abrasion are important. The high strength of Tenite, its wide color range, and its adaptability to fast molding make it the ideal plastic for many industrial and decorative uses. Write for a 52-page book on Tenite.

Faith Traphagen golf club ferrules
injection-molded of TENITE by Gits Corp.

TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Co.), KINGSPORT, TENN.

Patent information

Plaster casts and bandages, a necessary evil, have long been accepted alike by physician and patient in their familiar, rather clumsy form; but now a German inventor offers an improvement in a bandage which is quickly applied with no muss and little bother. The plaster of Paris is incorporated in a layer of a flexible cellulose ester (or ether) composition which is permeable to water. When the physician or surgeon applies the bandage he wets its surface; as the water gradually penetrates through the plastic layer it sets the plaster and the bandage or cast is complete. (Karl Mienes, Charlottenburg, Germany, U. S. Patent 2,053,728.)

A new, inexpensive plastic product called "fused wood pulp" is being made in Russia from sawdust or, better still, from straw. It is a brown or black material with fine-grained structure; the hardness is from 32.6 to 43.0 on the Brinell scale. One variety, sold under the name "Barkalait," is highly resistant to nitric acid but does not withstand hydrochloric acid so well. "Barkalait" is made by heating the wet sawdust or comminuted straw in an autoclave, drying and pressing at 390-465° F. and 400-1000 atm. pressure. Valuable plastics are made by blending it with Bakelite. Still other useful plastics are formed by condensing "Barkalait" with amino compounds. (T. Iv. and O. B. Iv, Journal of Applied Chemistry (U. S. S. R.), Vol. 9, pp. 322-334.)

A shock-absorbing case to protect watches from vibration and impact comprises a dustproof shield which holds the watch. This shield is a transparent celluloid receptacle with a convex bottom and outwardly curved sides, fitted into a case so that the shield touches the case only tangentially at sides and bottom. The flexible celluloid is thus able to absorb shocks communicated to the case from outside. (Ervin G. Seip, Kalamazoo, Michigan, U. S. Patent 2,053,784.)

A durable brake band which is characterized by exceptionally high heat resistance is made by mixing the fibrous base (which may be asbestos) with 1/8 or less of its weight of a fine metal powder such as copper or aluminum, free from graphite. The metal must be one which has high thermal conductivity. The Schoop metal spray process may be used to effect extremely intimate admixture of fiber and metal powder. This mixture is then formed into brake bands with the aid of 5 to 30 per cent by weight of a heat-hardenable synthetic resin binder. (Rodolphe Ballo and Ernest Molar, Hungary, French Patent 780,121.)

An arch support is now being made of wood veneer covered with soft leather or fabric. The tapered thickness from center to ends is imparted to the assembled arch support by suitable shaping of the wood veneer core and by interposing a fibrous nitrocellulose composition between the veneer core and the leather or fabric casing. (E. Steiner, 7 Simeon Barnutiu Str., Oradea, Roumania, British Patent 448,366.)

A new plastic molded golf club head gains all the advantages of a molded fibrous synthetic resin product (durability, resiliency and other merits), and yet retains the desirable weight and balance of a metal club head. This is accomplished by molding the head with a slot of appropriate size and shape with such a spacing in the club head that when the slot is filled with a lead plate the head has exactly the right weight and balance. The lead plate is cemented in place with a waterproof cement. (A. E. Lard, c/o the Westchester, Washington, D. C., British Patent 447,098.)

An improved collapsible tube is made of a polymerized acrylic acid ester and is formed in alternate layers of the polymer without and with a plasticizer. These layers are deposited on a glass or aluminum core in such a way as to form a thickened closure end; the closure is formed by cementing a block of the plasticized acrylic ester polymer to the thickened end. This block has a slit for the orifice and is reinforced by a metal collar which also serves to open and close the orifice by making a quarter turn of the collar. A metal strip is attached at the other end to maintain the shape of the tube as it is rolled up with a key. (E. Sander, Sander's Chemical Products, Ltd., 43 Regent St., Loughborough, Leicestershire, England, British Patent 446,945.)

A new type of hydrometer for testing the electrolyte in storage batteries is made of a sheet of celluloid fitted with lugs which space it from the cell wall of the battery and hold the instrument against a plate in the cell. An additional lug or lugs may be provided to keep the hydrometer from moving in the cell. The instrument is fitted with a hard rubber pointer which is weighted with lead. There are also stops which limit the movement of the pointer over the scale and serve to prevent warping of the celluloid sheet. Tests can be made very quickly and conveniently with the new device. (Arthur Wm. Browne, Electric Storage Battery Co., Philadelphia, Pa., U. S. Patent 2,054,691.)

A clutch plate which has exceptionally flexible and resilient faces is made by applying to both sides of a perforated metal plate a granulated cork composition in which the work particles are bonded together and firmly anchored to the metal plate by a plasticized synthetic resin binder. The plasticizer for this resin composition is chosen so that it also serves as a solvent and vehicle for the resin. Clutch plates made in this way are durable because they retain their frictional properties and because the facing adheres strongly to its metal base. (Andrew Weisenburg, Crown Cork and Seal Co., Baltimore, Md., U. S. Patent 2,054,210.)

Shutters of the type which can be rolled up are made by an inexpensive method which consists in sheeting a plastic material, cutting closely spaced grooves nearly through the thickness of the sheet so that ridges are left between the grooves, cementing the flat bottom surface of the sheet to a flexible backing material and bending the sheet to form cracks at the grooves and spread the ridges apart so that they function like the slats of a shutter. (Irving Florman, New York City, U. S. Patent 2,054,499.)

A novel method for making translucent motion picture projection screens is to fill the interstices of a sheet of cellulose acetate silk with a vinyl acetate resin, arranging the sheet either so that its transparency decreases from the surface toward the center, or so that particles of a finely comminuted solid are deposited at one surface to give a matt finish. Means are provided for keeping the sheet under tension during use. (Wm. H. Moss, assignor to Henry Dreyfus, London, W. 1, England, Canadian Patent 360,253.)

Porosity is imparted to grinding wheels and other shaped abrasive articles by a new method in which a blowing agent is incorporated with the synthetic resin and abrasive powder composition before molding. The blowing agent may be any suitable gas-evolving chemical such as sodium carbonate, ammonium carbonate or urea peroxide; or a resin may be selected which acts as its own blowing agent by evolving a gas when heated in the mold. The top of the mold is perforated with very small holes to permit the gas to escape. (Deutsche Gold- und Silber-Scheideanstalt vormals Roessler, 7 Weissfrauenstr., Frankfort, Germany, British Patent 448,102.)

WATERTOWN
COMBINED
BEAUTY *and* UTILITY

*in the molded handle
of this Prize Winning
Manning Bowman Iron*



One of the hardest assignments in all molding . . . the making of an iron handle. For it must withstand alternating heat and cold . . . plus the abuse of careless servants or housewives . . . and withstand this not for months but for a long term of years in intensive service.

Under such circumstances, the molder might be excused some sacrifice of beauty. But, because beauty sells the iron, Manning Bowman designers were most demanding in this regard.

The result, a triumph of molding, from any standpoint, is a product of the Watertown Manufacturing Company . . . an organization of molding technicians that stands ready to aid you in planning or to execute your plans to perfection, under the most difficult circumstances as well as in cases when the going is easier. Your inquiries are invited.

WATERTOWN MANUFACTURING CO.
1 PORTER STREET
WATERTOWN, CONN.

REED PRENTICE

Announces

A New, Fully *Automatic* Full Hydraulic INJECTION MOLDING MACHINE

General Specifications:

Capacity of Hopper Slide	7 c/in.
Gran. Material	2 ¹ / ₄ c/in. Moulded, 2 oz. Moulded
Estimated shots per hour	300-400, varying with type of part, 500 cu. in. moulded material per hr., 24 lbs. per hour
Maximum pressure per sq. in. on mate- rial	20,000 lbs. sq. in.
Pressure adjustable to	10,000 lbs. sq. in.
Maximum Injection area of mould ca- pacity	24 sq. in.
Diameter of plunger	1 ³ / ₄ "
Stroke	7"
Pressure Regulating Valve	
Approximate power consumption for heating unit	0.5 to 1.5 KWH
Size of die plates	18" X 20"
Capacity of Feed	
Hopper	20 lbs.
Space between bars	12" X 12"
Die Opening	8"
Maximum die space	12"
Minimum die space	4"
Diameter of tie bars	2 ¹ / ₂ "
Weight, approxi- mately	7600 lbs.
Oil pressure	1000 lbs. per sq. in.
Motor recommended	5 HP 1200 RPM
Base area	72" X 30"
Floor space	11'6" X 3'

Standard equipment to include 1000 lbs. Vickers Hydraulic pump with valve control and electric heating unit including rheostat for heat control of material. Arrangement made on heating unit for using thermometer or thermocouple—automatic counter can be supplied on special order. Machine operated manually and automatically—when manually it is operated with 2 levers, the first for closing the mold, the second for operating the horizontal plunger.

On the fully automatic machine two timing control units are furnished, one for the period for the material to solidify and one for regulating the time the molds are open for ejection of castings. These timing units can be adjusted from zero to 32 seconds. Stripper, for removing product from mold after ejection, is supplied.

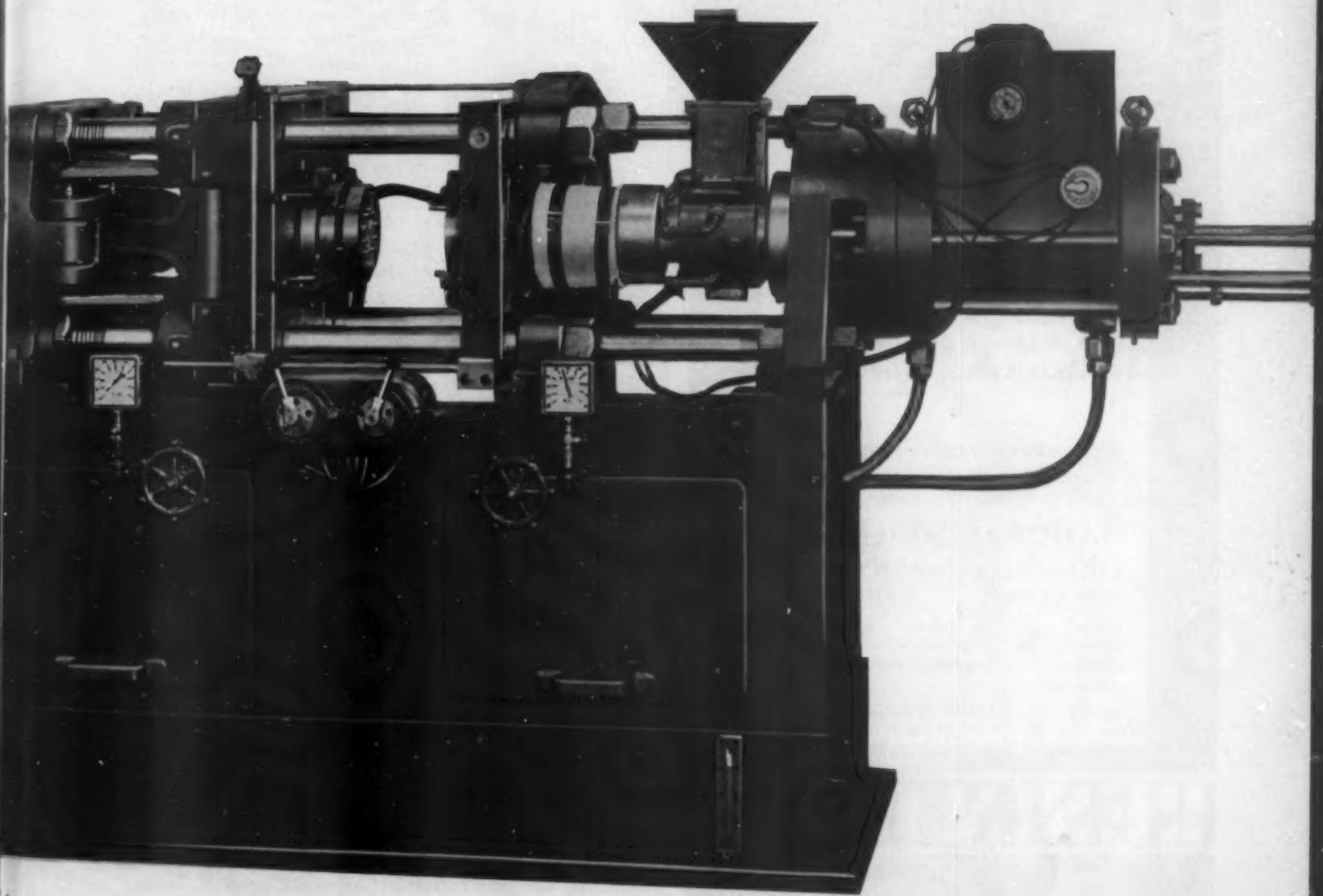
Other features of construction include positive toggle mechanism rigidly locking the molds mechanically and not depending on hydraulic pressure to hold molds closed. Hydraulic pressure is used to open and close molds only. Machine is operated by but one pump driven through 5 HP 1200 RPM motor. Base of machine acts as oil reservoir for hydraulic system making machine self-contained.



Reed-Prentice Corp. makers of machine tools, occupies a leading position in the manufacture of die-casting machines for zinc, aluminum and brass. Its leadership and experience in this related field has qualified its engineers to design a better, more foolproof, lower cost injection molding machine for the plastics industry.

This machine, designed after long research on the part of Reed-Prentice engineers—in cooperation with many of the foremost plastic engineers—is, in our opinion, the finest and most advanced yet on the market. In output, in quality of work, in freedom from complications and breakdowns, it offers much more than has hitherto been available.

We invite interested manufacturers to study the following specifications and to write us for full details and to arrange demonstrations.



REED-PRENTICE CORP.
WORCESTER MASS., U.S.A.




NATIONAL

RESIN COLORS

BRILLIANT UNIFORM

A COMPLETE LINE OF COLORS
SPECIALLY MANUFACTURED
FOR BOTH MOULDED AND
CAST PLASTIC COMPOUNDS

WE INVITE YOUR PROBLEMS

NATIONAL ANILINE &
CHEMICAL COMPANY, INC.
40 RECTOR STREET NEW YORK, N.Y.

BOSTON • SAN FRANCISCO • ATLANTA
PROVIDENCE • CHARLOTTE • CHATTANOOGA
CHICAGO • GREENSBORO • PORTLAND, ORE.
PHILADELPHIA TORONTO

Branches and Distributors throughout the World

RESIN DYES



BETTER READ THIS!

In the August issue of MODERN PLASTICS, there was an article, "Molded parts for assembling economy" written by Franklin E. Brill of General Plastics. It told how the Daystrom Corporation had worked out the problem of rapid assembly of their metal-tube furniture and smokers' accessories through the invention of friction-fit plugs of Durez, a molded phenolic material.

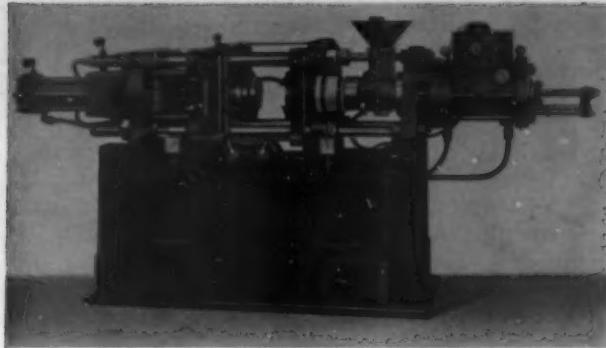
The final paragraph of that article was an added editorial comment not written by Mr. Brill, and reads: "We cannot help but advance the thought that many manufacturers with similar manufacturing situations might reduce assembly costs through adoption of friction-fit plastic parts as Daystrom has done. Shrinkage is entirely absent, the assembly operation is simple, the material is decorative, and its finish is permanent. Lamps for example, would benefit by this economy." This paragraph was appended for two good reasons: first, because the idea is a splendid one; second, because the story was just that much short of copy to fill the page. It now turns out that this company has applied for patents on this method of construction and so before you adopt the idea for your own use, you better get in touch with Mr. Dahmen of the Daystrom Corporation, Olean, New York, whom we understand is willing to negotiate on a reasonable basis with any one who is interested in this process and will write him regarding it.

Presenting new ideas for the information of our readers is our regular duty, but we have no intention at any time of suggesting the pirating of new ideas or design. In fact, we fight consistently against it.

GOLF AND RAIN AT LENOX

(Continued from page 34) Molding Co.; Ronald Kinnear, Niagara Insul-Bake Co.; Charles Lichtenberg, Resinox Corp.; E. F. Lougee, Modern Plastics; M. M. Makeever, Makalot Corp.; R. M. McGee, Plaskon Co.; Thomas McNicholas, Royal Molding Co.; Harold A. Myers, Terkelsen Machine Co.; F. A. Morlock, General Plastics, Inc.; D. O. Munns, Bakelite Corp.; J. B. Neal, Norton Laboratories, Inc.; L. J. Pentland, General Plastics, Inc.; Walter F. Reibold, Waterbury Button Co.; A. G. Robb, Butterfield Co.; J. L. Rodgers, Plaskon Co.; C. J. Romieux, American Cyanamid Co., Beetle Products Div.; G. Victor Sammet, Northern Industrial Chemical Co.; B. E. Schlesinger, Northern Industrial Chemical Co.; W. L. Searles, Tennessee Eastman Corp.; F. H. Shaw, Shaw Insulator Co.; C. J. Smith, Bryant Electric Co.; Horton Spitzer, Plaskon Co.; Norman Stafford, Diemolding Corp.; G. M. Stone, General Electric Co.; Edwin A. Terkelsen, Terkelsen Machine Co.; A. R. Van Horne, Niagara Insul-Bake Co.; H. H. Wanders, Northern Industrial Chemical Co.; A. E. Wells, American Cyanamid Co., Beetle Products Div.; and Douglas Woodruff, Auburn Button Works.

These names were copied from the Club Register and if errors or omissions occur they can be traced to a combination of poor eyesight on the part of your reporter and bad writing by those who registered.



NEW INJECTION MOLDING PRESS

Reed-Prentice Corporation has just announced its new injection molding machine which has been in the process of development for many months. The new machine is fully automatic and fully hydraulic and demonstrations are being arranged at the company's plant.

Standard equipment includes a 1000 lb. capacity Vickers hydraulic pump with valve control and electric heating unit including a rheostat for heat control of the material, and arrangement is made for a thermometer or thermocouple as well. The press can be operated manually if desired and two levers are provided, one for closing the mold, the other for operating the plunger.

On the fully automatic machine, two timing units are furnished, one for the period required for the material to solidify, the other for regulating the time the molds are open for ejection of castings. These timing units may be adjusted from zero to 32 seconds.

Other features of construction include positive toggle mechanism for rigidly locking the molds mechanically instead of depending alone upon hydraulic pressure to hold the molds closed. The hydraulic pressure is used only to open and close the molds. The base of the press acts as an oil reservoir for the hydraulic system making the machine self-contained.

General Specifications:

Capacity of Hopper Slide $6\frac{1}{2}$ c/in. gran. material
 $2\frac{1}{2}$ c/in. molded
2 oz. molded

Estimated shots per hour 300-400, varying with type of part
500 cu. in. molded material per hr.
24 lbs. per hour

Maximum pressure per sq. in. on material—20,000 lbs. sq. in.
Pressure adjustable to 10,000 lbs. sq. in.

Maximum Injection area of mold capacity—24 sq. in.
Diameter of plunger— $1\frac{3}{4}$ in.
Stroke— $6\frac{3}{4}$ in.

Pressure regulating valve
Approximate power consumption for heating unit—0.5 to 1.5 KWH

Size of die plates—18 in. by 20 in.
Capacity of Feed Hopper—20 lbs.
Space between bars—12 in. by 12 in.
Die Opening—8 in.
Maximum die space—12 in.
Minimum die space—4 in.
Diameter of tie bars— $2\frac{1}{2}$ in.
Weight, approximately—7600 lbs.
Oil pressure—1000 lbs. per sq in.
Motor recommended—5 HP, 1200 RPM
Base area—72 in. by 30 in.
Floor space—11 ft. 6 in. by 3 ft.



ERIE INJECTION MOLDING WINS 2 AWARDS

From over a thousand entries, judges in the First Annual Modern Plastics Competition have conferred the signal honor of two prize awards upon Erie Injection Molded Plastics.

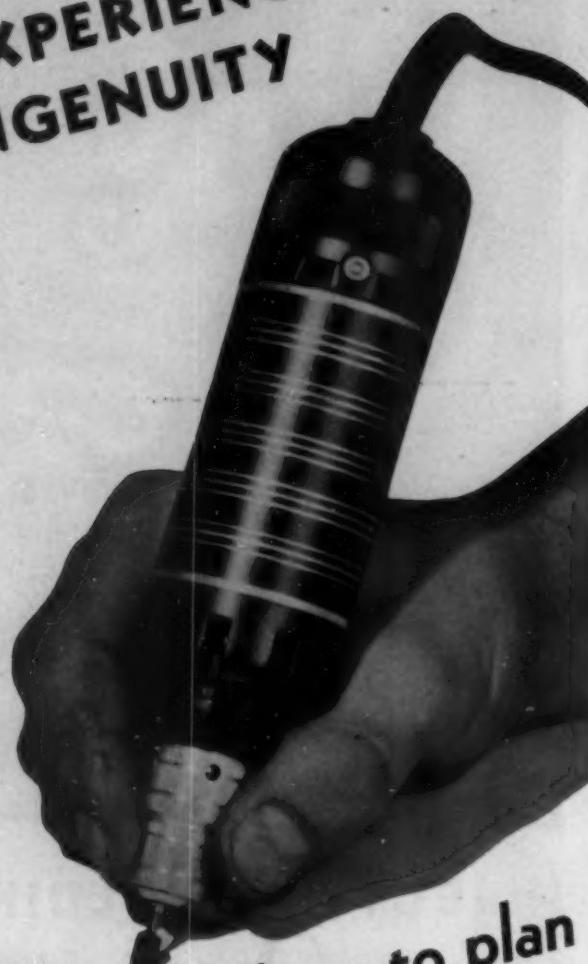
On the first prize Silvertone Radio, Erie is responsible for the focal point of the entire set; the cellulose acetate dial and the small volume control knob beneath it.

And in the Industrial Group the Erie bezel, a Tenite frame injection molded in one piece around 6" spherical glass, was awarded third prize.

The experience and skill of Erie design, engineering and production personnel responsible for these prize winners is at your call in solving your molding problems. A letter to us will bring you complete details on Erie Injection Molding.

ERIE RESISTOR CORP.—PLASTICS DIVISION
R 640 W. 12TH ST., ERIE, PA. R

SKILL
EXPERIENCE
INGENUITY



It takes all three to plan
a molding like this

The Chicago Wheel and Mfg. Company planned a hand-held high-speed drill and we were asked to design a mold for the housing. It sounds simple... but stop for a moment and remember that in addition to the usual molding considerations, that this housing had to stand up under the vibrations of thousands of revolutions per minute, under heat and shock, under rough handling and long wear.

In short, we wish to point out the advantages you may secure for your product... particularly when confronted with an out-of-the-ordinary problem... by consulting with this out-of-the-ordinary firm, mold makers of skill, experience and ingenuity who know how to attack and like to solve difficult problems.

We make no promises of easy solutions... but we do promise you every facility at our command. Write us and we'll put our engineers at your service.

INDUSTRIAL TOOL AND DIE COMPANY
2035 Charleston St. CHICAGO, ILLINOIS

CLASSIFIED

→ HYDRO-PNEUMATIC ACCUMULATOR: For Sale—One Watson-Stillman Accumulator, high and low pressure, complete with air compressor, air receiver, motor driven high pressure horizontal and low pressure vertical pumps; also Hydraulic Presses, 27" x 46" and 12" x 12" platens. Reply Box 134, Modern Plastics.

→ WANTED—PREFORM MACHINES: Will pay cash for idle or surplus preform Presses—also Hydraulic Presses, Pebble Mills, Mixers, Sifters, etc. Send us your list. Consolidated Molded Products Co., Inc., 13-14 Park Row, New York City.

→ HARDWOOD SAWDUST: We manufacture Fibrous Birch Sawdust used in the Plastic Industry, also Maple in fine, medium and coarse sizes. Ask for free samples and prices. National Sawdust Co., Inc., 104 North 1st Street, Brooklyn, New York.

→ Pennsylvania Corporation, opening a department early in the new year for molded plastics, is looking for sales representatives all over the United States. Applicants should forward complete details in first letter, so unnecessary correspondence can be avoided. Reply Box 166, Modern Plastics.

→ FOR SALE: Stokes Model "R" and Rotary "D" Preform Machines; Birmingham 15" x 36", 16" x 42" Rubber Mill and Calender; Werner & Pfleiderer Mixers, 9, 50, 100 gallon capacities. Stein-Brill Corporation, 183 Varick Street, New York, N. Y.

→ Energetic, serious minded young chap with well founded experience would very much like an opportunity to develop Foreign Markets and Overseas Trade for novelties and other Plastic Products. Prefer young aggressive organization sufficiently well financed for future development. Reply Box 167, Modern Plastics.

→ WANTED INTEREST in Plastics Molding Company by capable sales and advertising executive. Prefer small company now in or contemplating Injection Molding. Reply Box 168, Modern Plastics.

→ SUPERINTENDENT—desires new connections, sixteen years' experience as executive in mold and die building development, and production of molded and sheet metal products. Capable of assuming full charge. Reply Box 169, Modern Plastics.

BACKSTAGE

We are sorry about these

In announcing the winners in Modern Plastics Competition we unintentionally failed to give credit to the Imperial Molded Products Corp., Chicago, Ill., for engineering and molding the base and upright supports for the Burton X-Ray Projector which won Second Award in the Industrial Group.

We also erred in giving credit to Plaskon for the photograph of the Pilot Radio on page 85, October issue. This photograph was furnished by the Beetle Products Division of American Cyanamid Co., who supplied the molding compound and should have been so credited.

In checking final proofs of our Directory Section in the October issue, the names of Thomas Tibbs, 81 Gramercy Park, N.Y.C., and Joseph B. Frederico, 558 Portage Road, Niagara Falls, N.Y., were inadvertently omitted. They are both independent designers.

Better heat resistance

Temperatures up to 450° F. will not affect moldings made of improved heat-resistant material recently developed by General Plastics, Inc. The new material, available in black and brown and known as No. 34 and 37, is intended for such uses as electric iron handles, heater and appliance plugs, and other parts which must retain their dielectric strength without carbonization under relatively high heat. The material performs well, molds almost as fast as standard materials, and has excellent arc resisting properties as well as a smooth finish. It also has a very low water absorption rate.

Geers sails for Europe

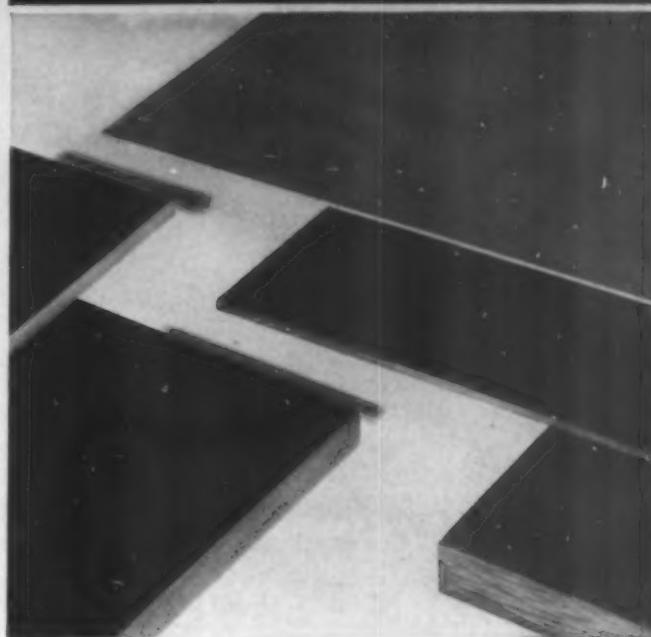
Joseph F. Geers, president of Index Machinery Corp., sailed for Europe recently in order to spend some time in intensive study of plastic molding equipment and plastic molded products. He is especially interested in the new Isoma injection molding press of which his company is the agent in this country. When he returns, he promises to write a short story of his experiences and discoveries in Europe for MODERN PLASTICS. It should be worth watching for.

Medal to Dr. Walter S. Landis

The Chemical Industry Medal for 1936 was presented on November 6 to Dr. Walter S. Landis of the American Cyanamid Company at a joint meeting of the American Section of the Society of Chemical Industry and the American Chemical Society, held at The Chemists' Club, New York City. Dr. M. C. Whitaker first spoke on the accomplishments of the Medalist and then the presentation of the Medal was made by Dr. D. D. Jackson of Columbia University. The American Section of the Society of Chemical Industry has planned the following meeting schedule for 1936-7.

December 11. Joint meeting with American Chemical Society, American Chemical Society in charge.

TAYLOR



● VULCANIZED FIBRE

● PHENOL FIBRE

● TAYLOR INSULATION

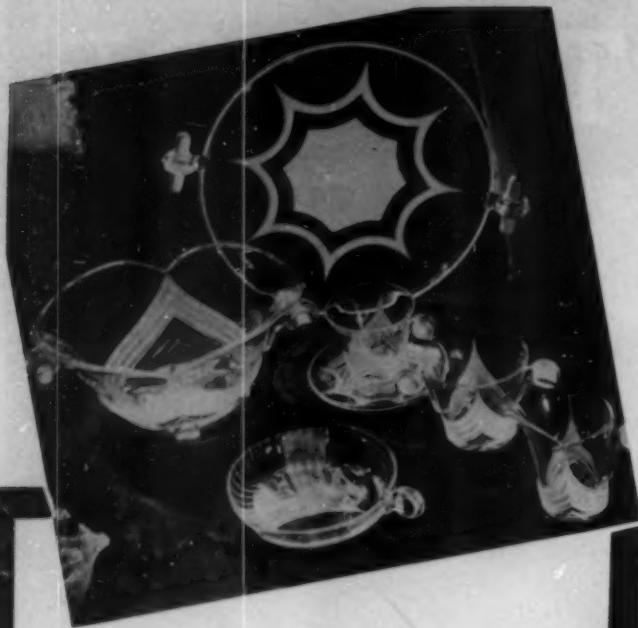
Taylor offers a complete insulation service to the modern Electrical Manufacturer.

Taylor Laboratory Controlled production in the world's most modern mill of its kind—provides positive uniformity of quality.

Taylor "Planned Service" geared to your particular requirements—whether large or small, standard or special—insures an unfailing source of supply, with prompt deliveries permitting you to operate with smaller inventories.

Ask about this unique service.

TAYLOR & COMPANY, INC.
NORRISTOWN, PA. . . Established 1891



Thank You! MODERN PLASTICS **FOR THE CHANCE TO POINT THIS MORAL FOR PLASTIC PURCHASERS.**

In selecting this luncheon set, with handles molded by Plastic Molding Corporation, for honorable mention in your Plastics Competition, you have given us a chance to point out a vital consideration to those who plan products involving the use of plastics.

There are three things, we say, that every manufacturer must demand in his molder. First, plant . . . modern machinery and a sufficient capacity to insure against rush-order shortages. You'll find such a plant at the Plastic Molding Corporation.

Second: Experience in plastic engineering and production planning . . . experience that often spells the difference between fruitful work and low costs and on the other hand, wasted effort and high expenses. At the Plastic Molding Corporation you'll find a corps of experienced engineers who think in terms of your problems and your merchandising needs.

Third . . . and perhaps most important . . . you want *ideas* . . . a product planning viewpoint that will complement that of your own engineers and designers. The ability to devise novel and practical solutions to problems as they arise . . . as we did in this instance using a two-piece screw-together molding to achieve a self-locking plastic handle for delicate glassware.

Before you choose your plastic molder . . . investigate this plant . . . judge it by these standards or any others you may set. You'll find we measure up to the highest by any standard of comparison.

**PLASTIC MOLDING
CORPORATION**

SANDY HOOK

CONNECTICUT

BACKSTAGE

January 8. Joint meeting with American Chemical Society, Society of Chemical Industry in charge. Perkin Medal award to Thomas Midgley, Jr., for work on anti-knock motor fuels, safe refrigerants, etc. Medal to be presented by Marston T. Bogert. Speaker on accomplishments of Medalist to be Robert E. Wilson.

February 5. Joint meeting with American Chemical Society, American Chemical Society in charge.

February 19. Meeting. Speaker, Dr. Wallace P. Coehoe.

March 5. Joint meeting with American Chemical Society, American Chemical Society in charge.

April 9. Joint meeting with American Chemical Society, Society of Chemical Industry in charge. To be announced.

Friends from abroad

L. G. Harrison, with A. S. Harrison & Co., Pty. Ltd., Sydney, Australia; E. W. Wiseman of Stadium Ltd., London; G. Norman Higgs, director Synplas Ltd., London; Lewis J. B. Forbes, managing director H. E. Ashdown Ltd., Birmingham; and M. de Laveaucoupet, manager of Société Industrielle des Comprimés de l'Ouest, Paris, were among our visitors at MODERN PLASTICS during the past two months.

Gabriel addresses Association

At a meeting of the Baskerville Association of Graduate Chemists of the College of the City of New York, held on Nov. 16, 1936, in the Doremus Lecture Hall at the College, C. L. Gabriel, vice-president of the Commercial Solvents Corporation of America, spoke on "Fermentation Processes in Industry," describing at length the process for making acetone and butyl alcohol from corn.

This process, first developed by Dr. Weitzmann in Britain, received considerable impetus during the War and is now employed by Commercial Solvents at their Peoria, Ill., Plant. With the aid of interesting slides the speaker gave a detailed analysis of the process, describing among other things, the generation of steam and electric power, the preparation of the sterile mash of corn meal, the successive inoculations of fermentation tanks of increasingly larger sizes with fresh culture, and the distillation of the fermented "beer" producing acetone, ethyl alcohol, and crude butyl alcohol. Mr. Gabriel then proceeded to show how Commercial Solvents utilized the hydrogen and carbon dioxide, two by-products, to make synthetic methanol.

Charles B. Buckingham

It is with genuine regret that we announce the death of Mr. Charles B. Buckingham, founder of the Watertown Manufacturing Company, Watertown, Conn. Mr. Buckingham passed away in his home on Oct. 17.

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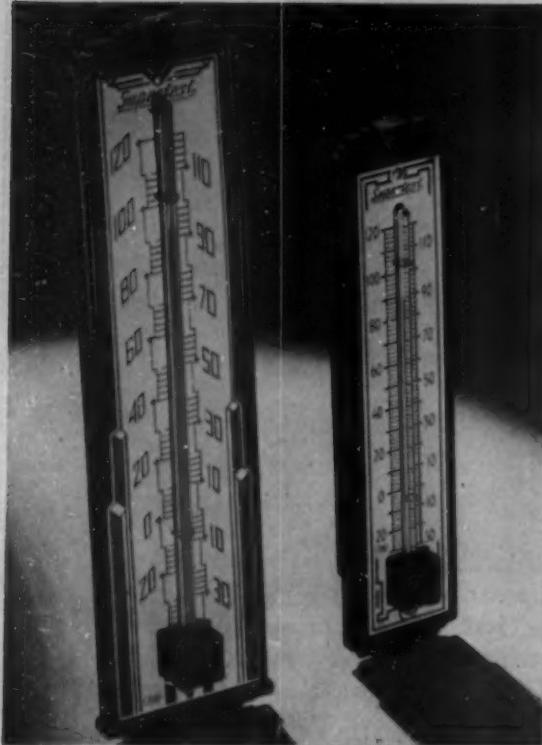
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SANTICIZERS
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SANTOLITES (Synthetic resins)
PHENOL
PHTHALIC ANHYDRIDE
MALEIC ANHYDRIDE
MALEIC ACID
ORTHODICHLORBENZENE
AMYL, BUTYL and
ETHYL ACETATE
DIACETONE ALCOHOL
MERSOL
(Solvent Alcohol)



BOOKS OF THE MONTH

Booklets reviewed in these columns will be sent without charge to executives who write for them on their company letterheads. Other books will be sent postpaid at the publishers' advertised prices.

Erie Resistor bulletin

The Plastics Division of the Erie Resistor Corporation has issued a bulletin describing Erie injection molded plastics. In addition to illustrating various pieces which this company has molded by the injection process, it also describes recent advances made in this new method of molding and its future possibilities.

Cellulose acetate booklet

A technical booklet, designed to serve as a guide to users and prospective users of cellulose acetate has been issued by the Cellulose Products Department, Hercules Powder Company, Inc. The material published is based on data and information obtained at the Hercules Experiment Station. The technical division of the company will gladly cooperate in supplying additional specific information and data on problems involving the use of cellulose acetate in lacquers, films, and plastics.

Molding with Lumarith

The Celluloid Corp. has published a new twenty-four page booklet which describes the development in the plastics field of injection molding with thermoplastics. Through a rapid cycle of production many colorful and intricate objects are produced at low cost. The booklet includes the properties, physical, chemical and mechanical, of Lumarith, its quality standards, applications, forms and storage, as well as thoroughly describing the injection molding process.

Chemicals by Glyco

The latest edition of "Chemicals by Glyco," published by the Glyco Products Co., contains a number of interesting additions. In particular, we note the special formulae section where suggested formulae are given of interest to many different industries.

An innovation which should prove of value to chemists and technicians is the policy of supplying special assortments of chemicals according to classification. For instance, Assortment A consists of the various emulsifying agents manufactured by the Glyco Products Co.

Synthane laminated tubing

The Synthane Corporation announces a new six-page general folder on the grades, physical, chemical, mechanical and electrical properties, shapes, characteristics and standards of quality of Synthane laminated tubing.

Interesting features of this folder are a two-color quick reference comparison chart of the test values of

Specifications:

MATERIAL:

PLASTICS

MOLDER:

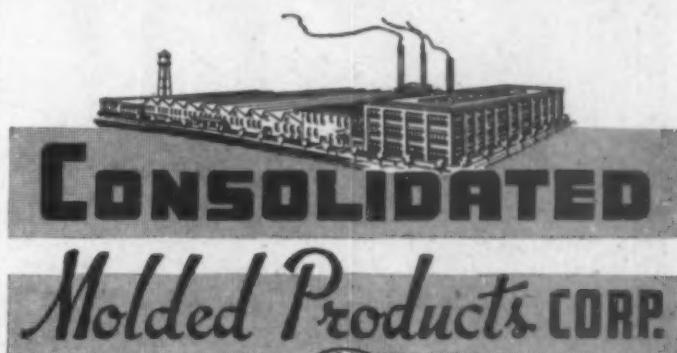
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San Francisco

BOOKS OF THE MONTH

rolled and molded tubes, including the tensile, compressive (axial and radial) and dielectric strengths, moisture absorption, power factor and dielectric constant. Those unfamiliar with the application of laminated phenolic tubing to chemical, mechanical or electrical design or production problems will find this folder helpful.

Engineers and chemists catalog

An eight-page folder introducing new books and equipment has just been published by the Chemical Publishing Co. It describes the new Gaulin laboratory colloid mill, thermocouple pyrometers, laboratory mixers, etc. There's a practical list of recent British books, and one page is devoted exclusively to unusual book bargains.

Chemical price list

The new quarterly price list issued by the R & H Chemicals Dept., E. I. du Pont de Nemours & Co., Inc., is ready for distribution and will be mailed without cost to interested readers.

Process News issued in pictorial form

A representative selection of more than a score of illustrations and shop views of recently built equipment, makes up the latest issue of "Process News," published by the F. J. Stokes Machine Company.

The photographs reveal a cross-section of the many kinds of apparatus recently furnished the chemical, process and pharmaceutical industries by this company, the equipment ranging from hand-operated to full-automatic machinery. The accompanying captions are concise, yet completely descriptive.

METHACRYLATE RESINS

(Continued from page 43) less plastic resin than an aliphatic alcohol of approximately the same molecular weight. This is very pronounced in the case of *p*-cyclohexyl phenyl methacrylate. The influence of four substituents in the beta-position of ethyl methacrylate is shown. Chlorine has no effect upon the plasticity. A phenyl and methoxy group increases the softness to the same extent. An ethoxy group gives a soft polymer. With two methacryl groups in one molecule as in the case of ethylene glycol dimethacrylate, an insoluble and infusible polymer results. The same type of polymer is obtained from methallyl methacrylate.

The softness of the higher aliphatic methacrylate resins can be decreased by interpolymerization with the harder methyl ester. A resin of any degree of plasticity can be prepared, varying from the hard methyl methacrylate polymer to the viscous liquid polylauryl methacrylate, by co-polymerizing the appropriate monomers in the correct proportions.

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Dibutyl Phthalate

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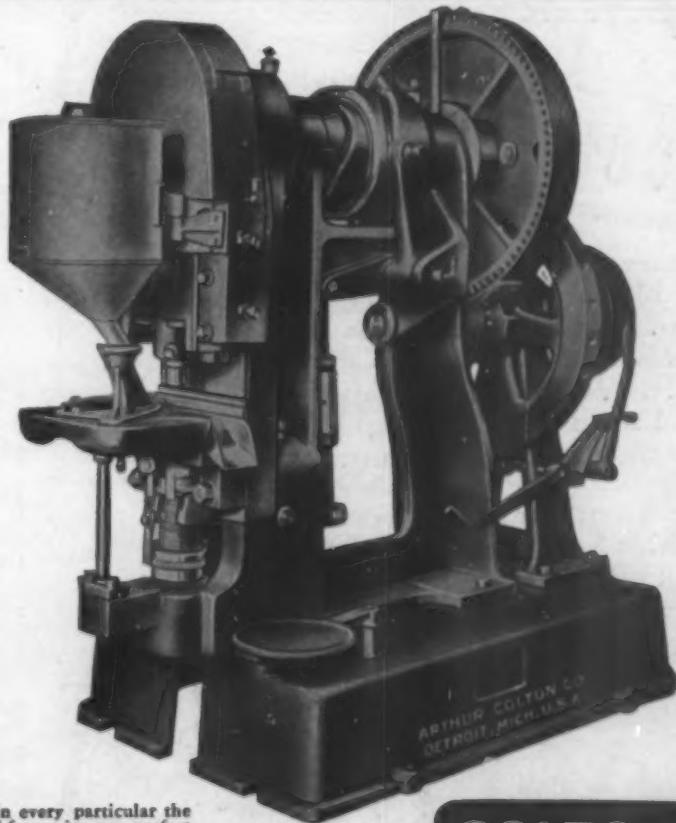
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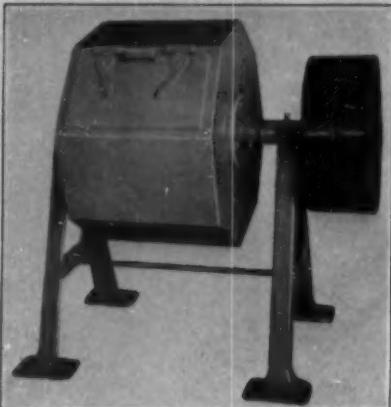
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EQUIPMENT—METHODS—FORMULAE

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These resins are compatible with most classes of plasticizers, including phthalates, tartrates, phosphates, adipates, etc. With high molecular weight aliphatic type softeners, compatibility is limited. Other materials, such as nitrocellulose, rosin, ester gum, damar, cellulose propionate, certain types of phenolic and alkyd resins, chlorinated rubber, coumarone resins, etc., are highly compatible with the methacrylate plastics.

Methacrylate ester polymers are surprisingly heat-stable. At 250° C. slight depolymerization can be detected. At 450° C. approximately 90% of the polymer can be depolymerized to the monomer which can be recovered and purified for reuse.¹³ This places a definite value on scrap polymer.

Applications and uses

The transparency, strength, high softening temperature, low specific gravity and chemical resistance of polymethyl methacrylate make it an outstanding plastic material of either the cast or molded type. The unusual clarity of this resin permits its fabrication into delicately tinted shades. With the combined use of dyes and pigments, materials of varying degrees of color and transparency have been prepared. The value of this resin is greatly enhanced by the ease with which it can be worked, as described previously, engraved with unusual effects, and cemented to itself to give joints which for all practical purposes are as strong as the resin itself. Methyl methacrylate is readily molded in compression molds under the same conditions used for other thermoplastic resins. Molding powders suitable for use in injection molding are being developed.

The glass-like transparency of these resins suggests many uses as glass substitutes where strength, lightness, ultraviolet transmissibility and ease of fabrication by molding are desired. Their substitution for glass in certain uses is facilitated by the remarkable chemical inertness of these resins. Among the many uses which have been evaluated and patented in the plastics field are safety glass interlayer,¹⁴ sound recording records,¹⁵ dentures¹⁶ and telephone and radio transmitter diaphragms.¹⁷

The low viscosity of the monomeric esters of methacrylic acid, together with the ease with which they can be polymerized, adapt them as impregnating agents which can be polymerized *in situ*. Various porous, fibrous and cellular materials, such as wood, cloth, wall-board, transite, cork, paper, electrical coils, stone, tile, etc., have been successfully impregnated in this way to obtain products with increased water, oil, alcohol, acid and alkali resistance. Monomeric methyl methacrylate has been used to impregnate wood to give a final product containing as much as 60% by weight of resin. Catalyzed monomer is readily absorbed by evacuated wood (pressure facilitates the impregnation, but is not necessary), following which the wood must be heated for several hours at elevated temperatures to polymerize the resin. Wood so treated has improved strength, and is resistant to warpage, water absorption and the action of chemicals.

The dielectric properties of methyl methacrylate resin make it of value in the electrical insulation and instrument field. Here again the transparency, non-tracking qualities, inertness to ozone, high softening temperature, strength, water, oil and chemical resistance, and the decrease of power factor with increase in temperature, combine to make this material of unusual interest. The monomer can be used to impregnate tightly wound electrical coils, following which the resin can be polymerized to give a thoroughly resin-filled appliance from which no solvent remains to be expelled. The fluidity of the monomer permits very rapid impregnation. Solutions of the polymer can be used also for the impregnation of coils, particularly where complete sealing is not necessary. Rotors and armatures can be dipped in resin solutions to bond the wires firmly in place. The toughness and strength of methyl methacrylate resin give it the ability to prevent movement of the wires under the centrifugal force developed at high rotational speeds.

Methacrylate resin treated paper and cloth have many uses. Paper, cloth, wire and other flexible materials can be impregnated with resin monomers, followed by polymerization *in situ*, coated with solutions of the resin polymers, or impregnated with aqueous resin emulsions.¹⁸ Paper and cloth treated in this manner become water, oil, alcohol, inorganic acid and alkali resistant with the result that these materials become of value in the electrical and food packaging industries. The treated paper and cloth can be laminated to obtain white, translucent sheets which are both strong and flexible. Because of these qualities and the low specific gravity of these resins, laminated stock prepared from them as well as the resins *per se* are of value to the aircraft industry. Methacrylate resin laminated paper and cloth can be dyed or pigmented to give colored translucent sheet stock which can be employed with marked success in the fabrication of lamp shades, etc. These resins have found application in the textile field as sizing and stiffening agents.¹⁹

Their clarity, light resistance, water impermeability, alcohol, oil, alkali and acid resistance, and general compatibility suggest many applications in the specialty coating composition field. The polymers dissolved in aromatic hydrocarbons, esters, ketones or chlorinated hydrocarbons can be applied by spraying, brushing, dipping or roller coating. Although any of the methacrylate resins can be used for this purpose, *n*-propyl, normal- and iso-butyl, or interpolymers of methyl with the softer resins are more readily adapted to general finishes use. Klein and Pearce²⁰ have included the study of polyethyl methacrylate and ethyl methacrylate-methyl acrylate interpolymer films in their investigation of the film-forming properties of acrylic acid resins. The extensibility and elasticity of poly-*n*-propyl and poly-*n*-butyl methacrylate films, particularly the latter, more closely resemble polyacrylate than polyethyl methacrylate films used by these investigators. Although the adhesion of methacrylate polymers is good, it is improved by baking.

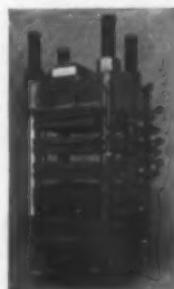
These are but a few of the many uses where the unique



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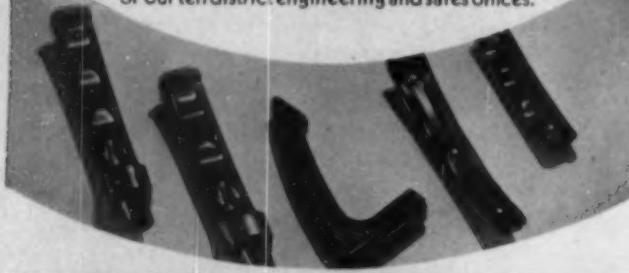
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properties of the methacrylate resins can be employed to advantage in almost every field of industrial endeavor.

- 1—Ellis, "Chemistry of Synthetic Resins," Vol. 11, p. 1080, New York, Reinhold Publishing Corp., 1935.
- 2—Neher, Ind. Eng. Chem., 28, 268 (1936).
- 3—Barrett, U. S. Patent 2,013,648 (September 10, 1935).
- 4—Crawford, U. S. Patents 2,041,890 (May 26, 1936) and 2,049,458 (June 2, 1936).
- 5—Izard, U. S. Patent 2,020,685 (November 12, 1935).
- 6—Reid, U. S. Patent 2,028,012 (January 14, 1936).
- 7—Ritchie, Jones and Burns, British Patent 424,885 (March 4, 1935).
- 8—Kuettel, U. S. Patent 2,008,719 (July 23, 1935); 2,044,359 (June 16, 1936); Loder, U. S. Patent 2,045,660 (June 30, 1936).
- 9—Crawford and McGrath, British Patent 427,494 (April 25, 1935).
- 10—Hill, U. S. Patent 2,046,651 (June 30, 1936).
- 11—Hill, U. S. Patent 1,980,483 (November 13, 1934).
- 12—Strain, U. S. Patent 2,030,901 (February 8, 1936).
- 13—Renfew, U. S. Patent 2,024,389 (December 17, 1935); Neher, U. S. Patent 2,032,663 (March 3, 1936).
- 14—Bren, U. S. Patent 1,997,572 (April 16, 1936).
- 15—Tidd, U. S. Patent 2,013,295 (September 3, 1935).
- 16—Harford, U. S. Patent 2,044,608 (June 16, 1936).
- 17—Strain, U. S. Patent 2,046,886 (July 7, 1936).
- 18—Strain, U. S. Patent 2,046,885 (July 7, 1936).
- 19—Klein and Pearce, Ind. Eng. Chem., 28, 635 (1936).
- 20—Klein and Pearce, Ind. Eng. Chem., 28, 635 (1936).

The writer is indebted to Drs. H. W. Starkweather and J. Harmon for some of the experimental data here presented.

THE HOOVER ONE FIFTY

(Continued from page 33) motor case offers many advantages over other materials. The saving in weight is sufficient to be well worth while, and, in addition, it permits holding dimensional tolerances very close, thus assuring accurate assembly and alignment of bearings, carbon brushes and field core. Furthermore, excellent electrical resistance is also automatically secured. The smaller parts—light socket, ventilating fan, handle plug and receptacle are made of standard molding material. The ventilating fan is $2\frac{3}{8}$ inches in diameter and weighs but .4 ounce. The molded bag connector flange acquires permanent color, high luster and light weight by the use of a dark gray molding material which harmonizes with the delicate color scheme of the Hoover One Fifty. The odd shape of this part, which is about five inches square, is easily obtained by molding.

The new model brings a basically new idea into the field of electric cleaners—the ensemble idea. This same principle has been established in costume, in decoration, and architectural units. Now it is being used by Hoover to increase the beauty, practicality and service of the electric cleaner. Surveys disclosed that because the cleaner was geared first to rug cleaning and second to other household cleaning, the latter did not get its share of attention. Surveys showed, also, that cleaning tools were not used because of the difficulty of attaching them.

The new One Fifty coordinates what have been heretofore "Accessory tools" as an essential part of the equipment. The small slot at the side of the machine is the receptacle for the attachment of household dusting tools. While the motor is running, the machine can be converted from rug cleaning to window sill cleaning—from lamp shades to floors. Upholstery, draperies, high places become as accessible as floors. A specially designed kit with all the tools in assigned places, as well organized as a carpenter's tool chest, hangs on the nearest door knob.

The predominating color of the machine is dark gray, with lighter gray and blue. The specially woven fabric, the blue and silver plaid on the hose, and the color of the hood and accessories, combine to make a new and dis-

tinguished appearance. Even the package in blue and gray has been designed to harmonize with the machine.

Functional to the last clamp, material and color and line have met the tests of use and practicality. The molded and metal parts are light in weight. The colors do not show dirt. The curves prevent jolting impacts. The shape of the handle makes a light grip effective. The levers and clamps are designed so that they hold firmly; so that the simplest twist sets them to work.

A touch of the toe adjusts the cleaner to any thickness of rug, and a spring cushion chassis takes it noiselessly over the door sill and rug edge. The handle goes automatically into three positions: straight for storage, midway for guiding, and low for use under beds and chests. When the bag is full of dust and its efficiency is being impaired, a warning red dot appears next to the hood. There is also a light in the hood to illuminate dark corners.

This new product is unique in the use of molded phenolics and die cast magnesium in a household device and was made possible by the constant search by the plastics and metals industries for new and better materials. These materials have been applied in new ways by intensive development of new part designs differing considerably from the usual practice.

RECORD ACHIEVEMENT

(Continued from page 19) factory electrical record reproduction at small cost.

Then, too, extensive improvements in disc recording and reproducing have made possible for the first time the development of a comprehensive Library of Recorded Music which includes representative works of more than 150 composers. The selections, which range from folk songs to symphonies, from 17th-century composers to George Gershwin, were made by a group of well-known artists and educators among which appear such names as Walter Damrosch, Geraldine Farrar, Sergei Rachmaninoff, Fritz Kreisler, Deems Taylor, Eugene Ormandy, Jascha Heifetz, Warren Storey Smith, Richard Gilbert and Paul Whiteman. The collection consists of 94 bound albums sold as a unit in a special cabinet and establishes a cultural foundation of good music in the home at a great saving of time and money for the average person who might wish to accumulate such expert selections. To go along with this Library of Music, RCA Victor has introduced a special phonograph-radio reproducing instrument which incorporates a newly developed dynamic amplifier. In making records, it is necessary for technical reasons to reduce the crashing climaxes of large orchestras and to build up soft passages. The dynamic amplifier in the new instrument automatically restores the proper intensity of sound in both instances so that the music reproduced in the home has all the volume and tonal quality of the original orchestra.

Another interesting development of plastic records is their use for educational purposes in institutions. The American Foundation for the Blind does its own recording of various types of sound programs as well as



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Cavagnaro-Loomis Vacuum Mixer
(Patented)

educational records and these are processed by RCA Victor. The possibilities of work in this direction are enormous and will undoubtedly still further swell the sale of records.

The superior characteristics of records with vinyl resin base have made them especially desirable for use with slide-films, a modern version of the old glass slides used to illustrate lectures or other special messages to the trade or the public. Realistic, life-like "stills" are placed in sequence on a strip of motion picture film and the accompanying message or script is recorded on a Victrolac record. The reproducing equipment consists of the film pictures, a turntable sufficient to accommodate a 14 in. disc, a loudspeaker and projection arrangement all within one cabinet. At proper intervals during the showing of the film, a tiny bell sounds from the record and the operator presses a button to change the picture. A surprising illusion of motion and realism is achieved. This method of instruction is less expensive than moving pictures and almost equally effective for the purpose.

Fifth: All these new developments have had a share in hastening the return of records for entertainment and educational purposes and RCA Victor has aided and abetted the latent desire for good music and programs, by extensive advertising campaigns.

This business of making records has always been a fascinating one and we accepted with alacrity an invitation to see how it is done. The process is divided into five groups: 1—The Recording Wax; 2—Recording the Music; 3—The Matrix; 4—Making the Biscuit; 5—Pressing the Record.

The recording wax, a blend of several natural waxes chemically treated, is melted and poured through a fine cloth into a circular mold where it is allowed to harden. The flat mirror-like surface on which the recording is engraved is produced by shaving with a sapphire cutter. The music is recorded in the studio where the recording wax is placed on a turntable revolving at the same speed at which the finished record is to be played. The sound waves are transferred from the microphone through amplifiers to a recorder fitted with a sapphire cutting point and electrical impulses cause the cutter to move in a lateral direction following the amplitude of the recorded sound. The wax on which sound waves have been recorded is then coated with a powder compound of high electrical conductivity and placed in an electroplating bath where copper accumulates on the newly coated surface. When the copper deposit becomes sufficiently thick it is separated from the wax record, which now having served its purpose is returned to the wax room where the grooves are shaved off and it is made ready for a new recording. The copper shell known as the "original" or "master" is plated with a coat of nickel and from it is made a second metal shell which is a duplicate of the wax, and from this second metal part is made the pressing matrix shell or mold. Since this shell is too thin for use in record production it is sweated or soldered to a flat copper disc which materially increases its durability. To prolong the life of the mold it is given a rather heavy electroplating of chromium.

The ingredients for the record biscuit are weighed in their proper proportions, mixed together on heated rolls, sheeted into small slabs and cooled. These slabs are delivered to the pressroom ready for the production of records. This record material is placed on a steam heated plate and when softened, is rolled into a biscuit shaped ball and placed on the mold in a hydraulic press, together with the record labels. The press is closed and hydraulic pressure—totaling seventy-five tons on a ten-inch record and one hundred tons on a twelve inch record—is applied. When flow has ceased, cold water runs through the press, chilling the mold and the record material. When cold, the press opens automatically and the record is removed. The flash is easily broken off by the operator and the edges of the record are later rounded by revolving them at high speed in a special lathe and rubbing the edge with sandpaper. They are then inspected and placed in envelopes. Periodically a record is taken from each press and played through to detect any defects that may develop in the mold during the pressing operation. If a defect is found the mold is rejected and replaced by a new set.

We couldn't help but be impressed by the general cleanliness and utter lack of dirt and clutter in the huge room, with its long rows of presses for molding records. The flash removed by the operator is deposited in receptacles placed near each press and hardly a scrap is allowed to fall on the floor. The same is true of the room where the materials are mixed and certainly here if anywhere one might expect to find a little mess and dirt.

Continuing our search for information anent the wide distribution of records, we stopped in at Electrical Research Products Inc., whom we had been told were large users of records for electrical transcription. With the expansion and development of radio for advertising purposes, some method was necessary to fill the time between sponsored programs and that was really where electrical transcription was born. But it rapidly acquired new importance and is being employed extensively at the present time in various ways. For example, radio time during the day increases in importance from about 6:00 p.m. to 10:00 p.m. After that it starts dropping off again. The hours with the most advertising value are from about 7:30 p.m. to 10:00 p.m. A program that goes on the air at 9:00 p.m. in New York might be received at 8:00 p.m. in some parts of the country and as early as six in other sections, and the advertising value at six in most instances is not nearly as good as at 9:00. By means of electrical transcription the same program can be broadcast at 9:00 in New York, 9:00 in Indianapolis and 9:00 out in the Mountain States or on the Coast, so the advertiser is assured of the most advantageous spot as far as time is concerned in each locality. Then, too, the habits of people in different sections of the country vary considerably. While 9:00 o'clock in the evening might be a good hour to reach a maximum of listeners in New York, a comparable time in some Southern or Northern states might be 7:30. Electrical transcription makes it possible to arrange the program to suit the differences in local habits, which means that selec-

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tive broadcasting, as it is called, is a decided advantage to sponsors of radio programs. Programs for electrical transcription are made up much the same as for ordinary radio broadcasting and recorded on large records. In some instances programs are recorded while they are being broadcast, by direct telephone wires, and a week or so after that those records may be released all over the United States for re-broadcasting. ERPI sends records to 378 radio stations all over the country and some sponsors' programs are sent to that many stations three times a week. We learned that ERPI molds its own records using vinyl resin almost exclusively for this work because of its advantages over contemporary materials.

In the present stage of our human existence there are thousands among us who have tired of radio as we did of the phonograph but not for the same reason. There are many with keen appreciation of music who resented the lengthy advertising announcements that were sandwiched between delightful minutes spent listening to the music of a favorite composer or a band of our personal preference. This is especially true of hotels, clubs, restaurants, as well as some private homes. Electrical transcription has furnished a means of getting around this prejudice. The Muzak Corporation supplies a service whereby with a turn of the knob on a special receiving set, musical programs may be brought in without announcements or advertising of any kind. Vinylite records manufactured under the ERPI patents are reproduced in specially constructed studios and sent out over telephone wires to subscribers, through a control room that looks like a huge telephone switch board. All of the programs are musical and are available twenty-four hours a day. Special programs are arranged at the request of subscribers. For example, if a subscriber wants a wedding march or any other piece played at a certain time, he need only notify Muzak and the music will be on hand when it is wanted. The lines can be controlled so that the music reaches the spot where it is wanted and different programs can be sent to different spots at the same time. Subscribers enjoying this service have a choice of music on tap played by the finest orchestras. The receiving instrument is in cabinet form much like an ordinary radio and comes in large and small sizes.

Unquestionably, for all of these concerns, modern records of vinyl resin base have proved their worth. They are particularly indispensable for use in electrical transcription and for the slide films and educational records produced by RCA Victor, and they are creeping into production also for home use. During our travels we learned the reasons for this. Records made with vinyl resin base are harder and have longer life than those made from other materials. They seldom crack and will break only under extreme conditions which means fewer losses from breakage in shipping. They are not affected by humidity or changes of temperature in different sections of the country and consequently will not warp or distort. The fidelity of reproduction is high, faithfully recreating instrumental and vocal music with an almost complete absence of surface noise, which is an extremely important factor especially in electrical transcription

work. The records are much longer playing, since the grooves can be very close together; in fact, as many as 196 grooves to the inch, which is practically impossible on other types of pressings. This means that four, five and six musical numbers can be recorded on a 12-in. disc in comparison with one or two on the old records, while as many as eight to ten numbers can be included on a 16-in. disc.

In making vinyl resin records, practically all scrap or flash may be reused as well as defective moldings when ordinary care is taken to keep the material free from dirt. The elimination of material loss is of great importance particularly in the manufacture of sound reproducing records where the flash or scrap may amount to 25 to 30 per cent, which if not reusable would present a prohibitive material cost.

This making of records for so many diversified modes and means of entertainment is but one of the uses of this new resin which has increased in production from a few thousand pounds in 1929 to several million in 1935 with a very definite indication of a healthy growth for 1936 with innumerable new and equally interesting applications. Its contribution to the return of popularity of phonographs for home use where programs of entertainment are made available without advertising is indicative of the general contribution which organic plastics are making to our present mode of living and to the ever-changing progress of diversified industrial activities.

SYNOPSIS OF RESINS

(Continued from page 39) When organic dihalides of the type X-R-X, for example, ethylene dichloride, Cl-CH₂CH₂-Cl, are reacted with inorganic polysulfides, for example, Na₂S₄, in the presence of a suitable dispersing agent, an insoluble organic sulfide and an inorganic salt are formed. These organic polysulfides are for the most part high molecular weight chain polymers that either possess, or can be made to assume, highly rubber-like properties. Part of the sulfur present can be easily removed with sodium hydroxide to give a material corresponding in analysis to a disulfide. This disulfide can be further reduced to the dimercaptan. Starting with the dimercaptan, the high molecular weight disulfide can be regenerated by moderate oxidation. The disulfide can then be made to recombine with sulfur to give the original organic polysulfide. The presence of the coordinately combined sulfur greatly modifies the properties of the chain polymer. With certain organic radicals, the disulfide structure imparts rubberlike properties, while with others sulfur in excess of that required for a disulfide linkage is necessary. In all chain polymers it is necessary to assume some type of terminal group. In this reaction the chain will be terminated by either a halogen atom or a polysulfide group, depending on which reactant is kept in excess. There is a slight modification of the properties of the finished polymer, depending on the type of terminal group present. When the polysulfide is kept in excess



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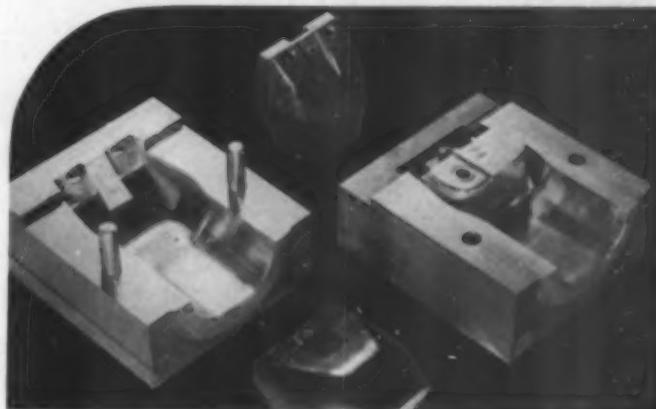
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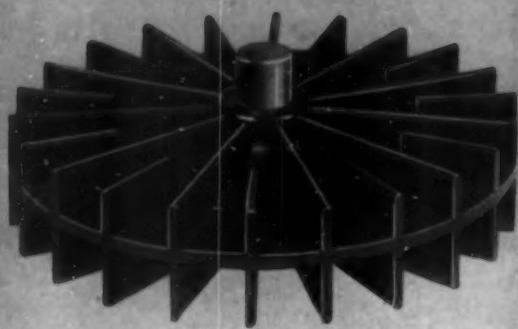
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and the washed polymer acidified, a product is obtained which is analogous to natural rubber, in that it is capable of further polymerization by vulcanization with oxidizing agents. The phenomenon of cure is not fully understood. The evidence points to its being brought about by the oxidation of mercaptan terminal groups on the long chain polymers to form polymers of even greater length. Cross linking between chains may also occur.

The Treatment of Wood with Synthetic Resin Forming Materials as a Means of Minimizing Swelling and Shrinking, by Alfred J. Stamm and R. M. Seborg. Shrinking and swelling and the accompanying warping, checking and honeycombing of wood constitute its most detrimental property. Because of this, considerable effort has recently been made by the Forest Products Laboratory to minimize the dimensional changes. A number of different species of wood were treated with various phenol-formalin ammonia mixtures in both water and methyl alcohol. The methyl alcohol serves as an inhibitor to prevent the formation of a resin during treatment and as a mobile easily diffusible solvent which can readily be removed from the wood by evaporation. Treating the wood with a partially or completely resini-fied resin dissolved in a solvent is not nearly so effective in minimizing dimension changes as when the wood is treated with the resin-forming constituents and these are converted into a resin in place. This is undoubtedly due to the rapid and far more complete diffusion of the smaller resin-forming molecules into the fine capillary structure and their more perfect bonding to the wood. The treatments were made in pressure treating cylinders by evacuation to remove the air from the capillary structure of the wood. The resin-forming solution was then run into the cylinder and pressure applied. After allowing sufficient time for diffusion, the wood was air dried, followed by drying at 70 degrees Centigrade, and curing at 105 degrees Centigrade. The synthetic resin treatments not only decrease the rate of moisture absorption by wood as is the case with wax treatments, but they definitely change the moisture equilibrium. Reductions of the swelling, on an equilibrium basis, to 30 per cent of that of untreated wood were obtained when the wood took up 30 to 50 per cent of its weight of treat-ing material. A 50 per cent reduction in swelling was noted when the wood increased in weight as little as 15 per cent.

Utilization of Sawdust as a Plastic Material, by E. Bateman, E. Beglinger, J. P. Hohf, E. C. Sherrard and H. D. Tyner. Vast quantities of sawdust result from the milling operations in this country. Very little of it is adequately utilized. In some cases it is burned to generate steam for milling operations but on account of its bulkiness it is an inefficient fuel. This research was thus undertaken to find a means of utilizing this waste material. Several different chemical treatments of the sawdust have been found that convert it into a plastic molding material: (1) hydrolysis by acids; (2) chlorination; (3) hydrolysis by water in the presence of some reacting material; and (4) esterification. In some

cases the preliminary treatment followed by washing and drying produced powders which could be pressed into sheets without further addition of chemicals, if the temperature and pressure used were high enough. For the most part, however, the addition of some sort of liquid material was necessary to act either as a binder or as a lubricant during the pressing process. A large variety of materials was tried in combination with the digested sawdust. The most satisfactory combination found was aniline and furfural in approximately equal proportions, about 6 to 8 per cent of each giving the best results. The treated molding powders were placed in molds in a hydraulic press and subjected to pressures of 2000 to 3000 pounds per square inch and a temperature of 137° C. for about 15 minutes. The product is black and very similar to phenolic molded products in appearance. Because of its low cost, approximately 3 cents per pound, this wood plastic may find uses in which its water absorption and swelling characteristics are not objectionable, thus making possible the utilization of a large part of the waste sawdust.

Varnish Resins from Cracked Distillates, by Charles Allen Thomas and Frank J. Soddy. Certain classes of reactive hydrocarbons produced by the pyrolysis of hydrocarbons under carefully controlled conditions can be polymerized to compounds of relatively low molecular weight, the polymerization stopped, and the resulting resins incorporated with drying oils to form varnish films which undergo a secondary polymerization to form tough, durable protective coatings. The nature and extent of the secondary polymerization is dependent upon the character of the hydrocarbon employed in making the polymer and the degree of unsaturation of the resin, which can be controlled by varying the conditions under which the cracked distillate is polymerized. Hydrocarbon resins produced by the polymerization of cracked distillates possess unusual dispersing and wetting characteristics. In producing enamels, the pigment is ground with a suitable varnish. The ability of the resin contained in the varnish to disperse the pigment governs the amount of grinding necessary to make a smooth, free flowing film. Certain natural and synthetic resins require drastic grinding in stone Buhr mills to completely homogenize the varnish and pigment and form a colloidal solution capable of meeting the industrial requirements for a satisfactory enamel. It has been found that hydrocarbon resins of this type require less grinding than varnishes made from other types of resin, both natural and synthetic. The dispersing power of a solution of these resins in hydrocarbon solvents is quite unusual. A 50 per cent solution of Santo-Resin, the trade name of a hydrocarbon resin, in a petroleum solvent will disperse zinc oxide so completely that no separation occurs for several days, while the same solution made with a natural resin, such as rosin, stratifies almost immediately. It has been shown through measurements of the settling rates of the various pigments that the hydrocarbon resin has far greater dispersing properties than various other synthetic resins which were examined.



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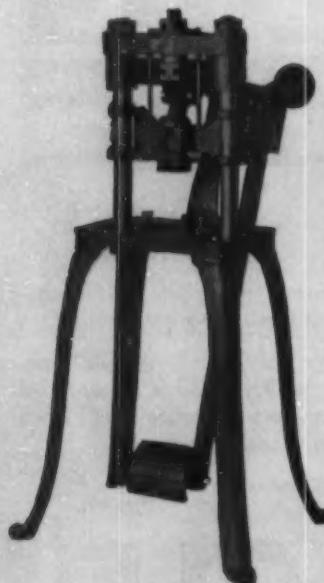
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Methods of Testing Plastics, by G. M. Kline and B. M. Axilrod. The clarity and scratch resistance of transparent plastics are of prime importance in connection with their use as windshields on aircraft. In a study of these materials at the National Bureau of Standards in cooperation with the National Advisory Committee for Aeronautics, special methods have been developed for the measurement of these properties. The apparatus for evaluating clarity consists essentially of a photoelectric cell, a light source, a 6-volt storage battery, and a microammeter. The percentage of light transmission of the plastic is measured with the sample covering the aperture of the photocell, which is inclosed in a blackened box. A measurement is then taken with the sample placed over an aperture at the light source, 18 inches distant from the photocell. The difference between the two readings is a measure of the light scattered by particles and surface imperfections. Haziness is defined as the percentage of the total light transmitted at the photocell which is scattered when the sample is placed over the aperture at the light source. A sclerometer used in testing metals, namely, the Bierbaum "microcharacter," was found to be suitable for measuring the scratch resistance of plastics. Comparison of the scratch hardnesses with the indentation values indicated that for some materials the two hardness coefficients are not similar.

The Polymerization of Vinyl Acetate, by K. G. Blaikie and R. N. Crozier. The effects of time, temperature, catalysts, and solvents on both the reaction and the product of the polymerization of vinyl acetate were discussed. A polymer of vinyl acetate which is insoluble in the common organic solvents is formed in minute quantities during the manufacture of the soluble form on a commercial scale. It is similar to the ordinary insoluble polymer which is more readily prepared by carrying out the polymerization in the absence of solvents. This insoluble material does not appear to be formed by the continued addition of monomeric vinyl acetate to a chain to produce an enormously long molecule. Preliminary investigation indicates that a weak link between chains is formed, giving a lattice or bridged structure. On long heating at elevated temperature with acetic acid, pyridine or Cellosolve, the polymer dissolves and apparently has the properties of the ordinary soluble modification. The copolymer of vinyl acetate and divinyl ether is insoluble in the common organic solvents. It differs from the ordinary insoluble material in being more resistant to the action of solvents and does not dissolve even in hot acetic acid. It is comparable to the bodies described by Staudinger as resulting from the copolymerization of styrene and divinyl benzene.

Polymer Distribution in Vinyl Ester Resins, by S. D. Douglas and W. N. Stoops. Methods of determining polymer distribution, or the percentage composition based on the degree of polymerization, are necessarily very limited. The ultracentrifuge has proven its usefulness for this purpose, but the equipment required is too complicated and expensive for general use. Separation

of a resin into various fractions by extraction with different solvents is fairly satisfactory when it is soluble and of such a low overall degree of polymerization that there are appreciable differences of solubility among the various polymer bands. The copolymer of vinyl chloride and vinyl acetate can be separated into bands of different molecular weight and physical properties by repeated extraction with different solvents or by fractionally precipitating it from solution. Data obtained on a series of carefully prepared fractions made from the same resin show that most of the physical properties of the resin are determined by its degree of polymerization. Tensile strength, impact strength, modulus of rupture, and modulus of elasticity all show the same type of variation, namely, a rapid increase from a very low value in the molecular weight range 5000 to 8000, followed by a much more gradual increase for higher molecular weights. The plasticity of the resin and the viscosity of its solutions are also largely determined by the molecular weight. Certain other properties, such as water absorption, hardness and refractive index are practically independent of molecular weight. Other vinyl resins such as polystyrene and polyvinyl chloride do not show enough difference in solubility among the polymer bands present to enable a method of this kind to be used advantageously. However, polyvinyl acetate is, in most commercial grades at least, of such a degree of polymerization that it can be analyzed by a similar procedure.

Methacrylate Resins, by H. R. Dittmar. Polymerized methyl methacrylate possesses outstanding qualities among resinous materials, for in addition to its unique clarity, it has a high softening temperature, high tensile and impact strength, excellent dielectric properties, low specific gravity, is stable to light, odorless, tasteless, will transmit ultra-violet light of wave length as low as 2500 Angstrom units, is internally reflective, and is unattacked by the usual inorganic reagents and some of the more common organic solvents. A large number of aliphatic, aromatic, and heterocyclic esters of methacrylic acid have been synthesized and studied. Methacrylic acid esters can be synthesized by the dehydrohalogenation of alpha and / or beta halogenated isobutyric esters, or from acetone cyanhydrin by dehydration, hydrolysis, and esterification. The monomeric esters are relatively volatile liquids of low viscosity. The methyl ester boils at 100.4° C. and has a relative viscosity of 0.588 at 22° C. These esters can be polymerized directly into solid glass-like resins of any desired shape in predesigned molds or can be first polymerized into a molding powder which can be molded in any manner suitable for a thermoplastic material. The pure monomeric esters are quite stable and can be stored cool for months without polymerizing. The polymerization is catalyzed by oxygen, heat, and light. Active oxygen-containing compounds, such as ozonides, hydrogen peroxide, benzoyl peroxide, acetyl peroxide, and the like, are vigorous catalysts. The polymerization of methacrylate esters is inhibited by hydroquinone, pyrogallol, and antioxidants of this general type.



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